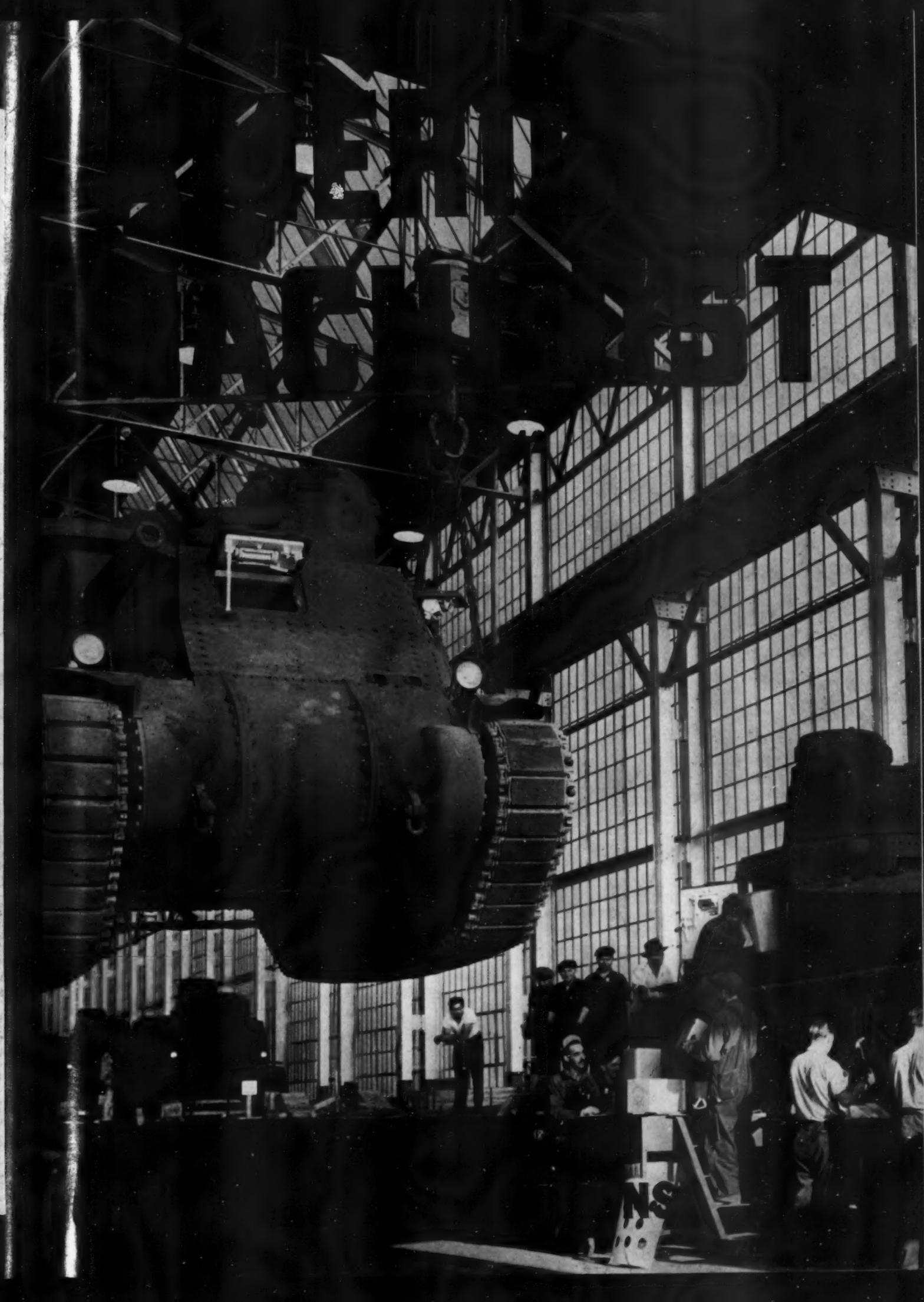
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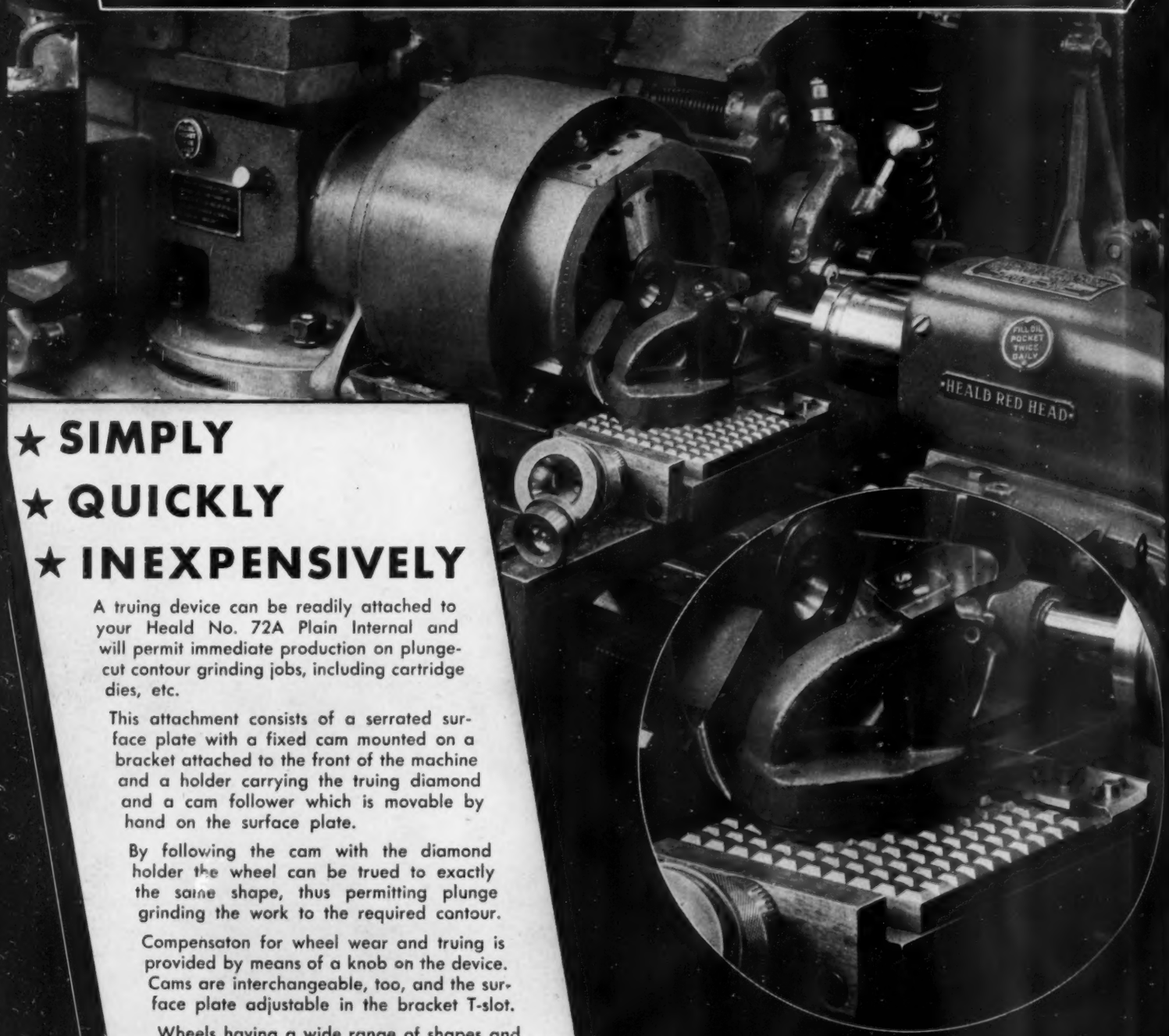
Lick Your Contour Grinding Jobs with your present HEALD INTERNAL



★ SIMPLY
★ QUICKLY
★ INEXPENSIVELY

A truing device can be readily attached to your Heald No. 72A Plain Internal and will permit immediate production on plunge-cut contour grinding jobs, including cartridge dies, etc.

This attachment consists of a serrated surface plate with a fixed cam mounted on a bracket attached to the front of the machine and a holder carrying the truing diamond and a cam follower which is movable by hand on the surface plate.

By following the cam with the diamond holder the wheel can be trued to exactly the same shape, thus permitting plunge grinding the work to the required contour.

Compensaton for wheel wear and truing is provided by means of a knob on the device. Cams are interchangeable, too, and the surface plate adjustable in the bracket T-slot.

Wheels having a wide range of shapes and sizes can therefore be trued for grinding all kinds of contour work.

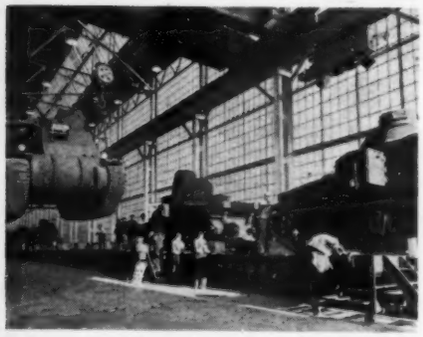
Contact us at Worcester or one of our branch offices in your locality for details.

By means of the contour truing attachment furnished on this Heald No. 72A Plain Internal form wheels for plunge contour grinding various types of cartridge dies can be easily and quickly trued to the exact shapes desired.

THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

AMERICAN MACHINIST

June 11, 1942



Tanks for Yanks—and all the United Nations; from the converted auto industry comes a flood of munitions

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VOLUME 86 NUMBER 12

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MOTOR CARS TO MUNITIONS

(See Section Facing Page 88)

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How this Issue can help you

This "Motor Cars to Munitions" Number is designed as a handbook for all Metal-Working production men engaged in conversion to armament manufacture. It tells how automotive plants have solved many planning, retooling and production problems, and contains countless ideas and suggestions applicable to other types of plants. The following highlights of the issue may guide you to the information you are looking for today:

NO matter what type of war goods you produce, you'll be interested in the over-all picture of the conversion job which faced the AUTOMOTIVE INDUSTRY, and how it is being tackled.

• If you can't get the new armament-making machines you need, read how CHRYSLER CORPORATION got into production quickly by revamping old equipment.

• For a broad, comprehensive view of how an entire company can convert plants, machines, equipment and workers to 100% war production, read the story of what has happened at FORD.

• Are you debating how far to go in tooling up? BUICK found that adequate tooling costs no more than make-shift methods.

• Maybe you can use a lot of your present machines despite a radical difference in the new parts to be made. CADILLAC did.

• For greater war output at lower cost, take a tip from the way CHEVROLET has developed improved tooling.

• Your war work may be so different that both supervisors and workers must be trained. See how FISHER BODY handled it.

• Extensive subcontracting may help you, as it helped OLDSMOBILE, get into production rapidly.

• "Ahead-of-schedule" production brought in more contracts for PONTIAC . . . and might for you.

• As an example of how to train employees (including women) to do war work, see how HUDSON operates its three-week classes to teach the tricks of the trade.

• You may be in the same situation as NASH-KELVINATOR, who made extremely effective use of practices from other plants in turning to their own war production.

• PACKARD may have a retooling lesson for you in the way they converted three machine tools for every two new ones purchased.

• Perhaps your problem is to create an entirely new assembly line to meet the required production schedule. See how STUDEBAKER did it successfully.

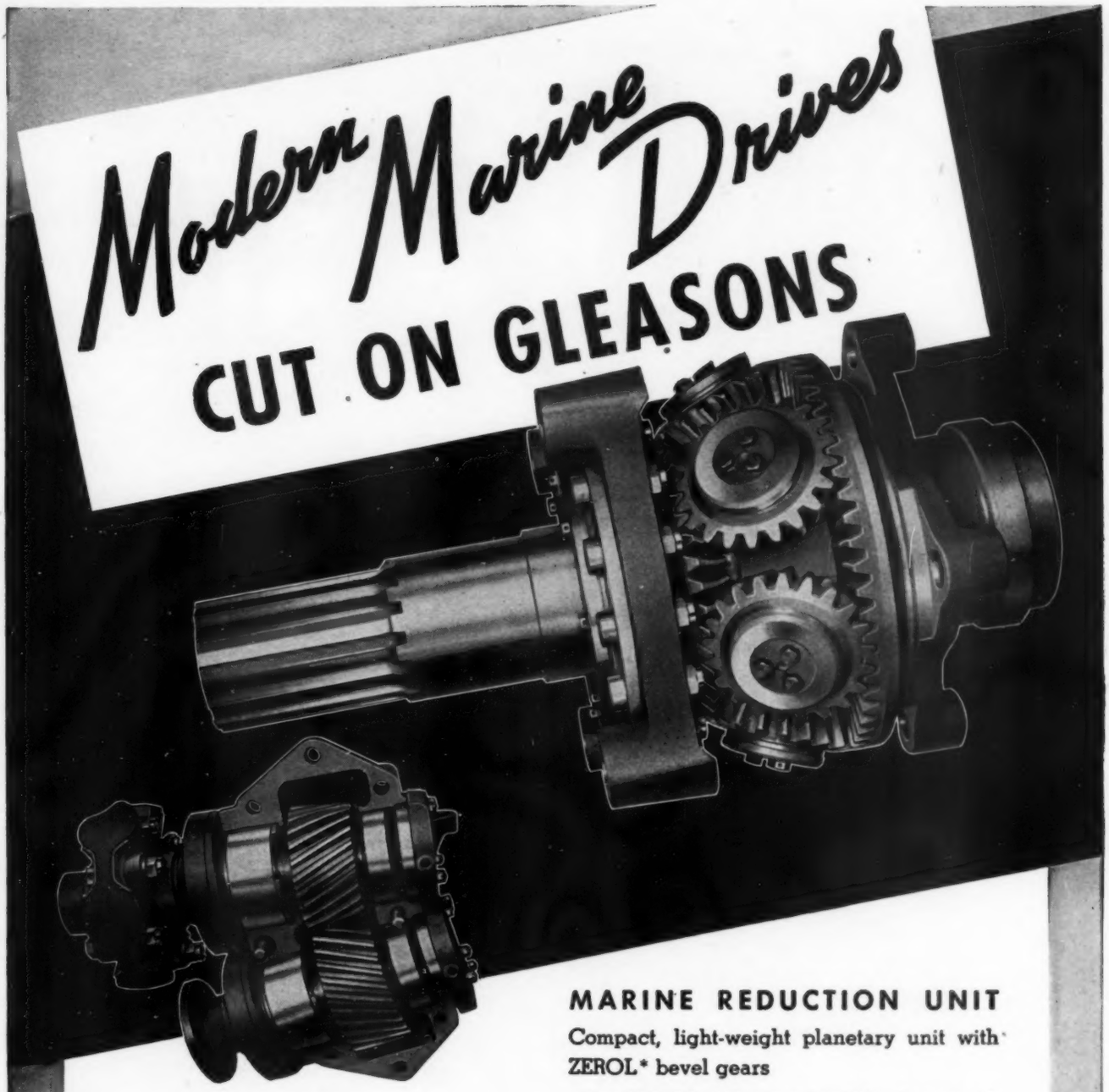
• If you're figuring on making a *variety* of war items, instead of concentrating on a few, read about the diversification at WILLYS.

MOTOR CARS TO MUNITIONS NUMBER

A Timely Report ★ A Handbook For Immediate Use ★ A Reference For the Future

Modern Marine Drives

CUT ON GLEASONS



MARINE REDUCTION UNIT

Compact, light-weight planetary unit with ZEROL* bevel gears

*Reg. U. S. Pat. Off.—curved-tooth bevel gears with zero spiral angle and same low thrust loads as straight bevel gears.

V BOAT DRIVE

With angular spiral bevel gears, engine is mounted horizontally in stern for best weight distribution

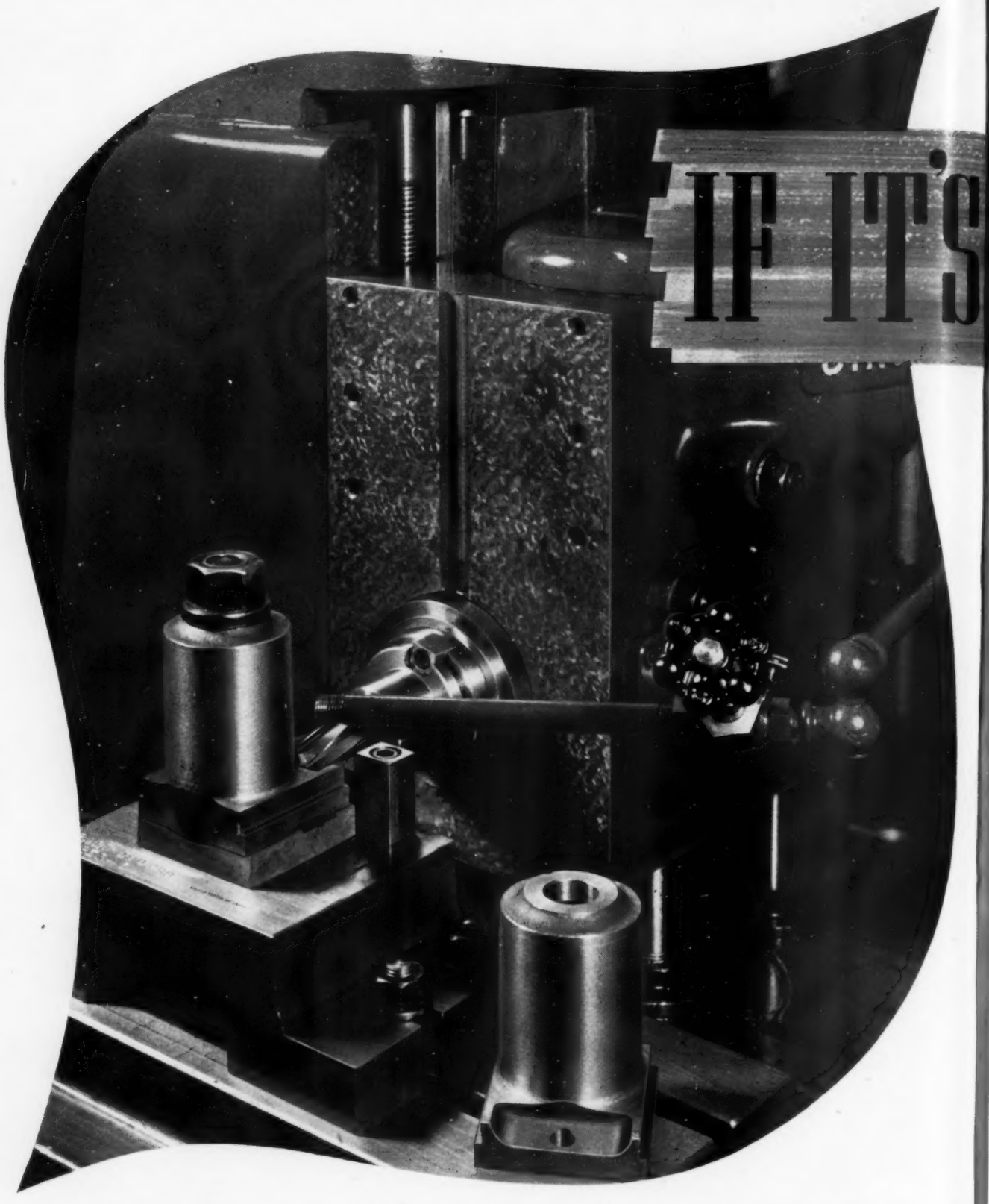
For engineering recommendations on bevel and hypoid gears, write Gleason Works

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.



Innumerable small parts are being milled on CINCINNATI No. 0-8 Plain Automatic Milling Machines. Parts for small arms, airplanes, range finders, photographic equipment, tanks, instruments. fuses and hundreds of other essential items.

CINCINNATI

WIN *with a Cincinnati!*

Stamina YOU WANT

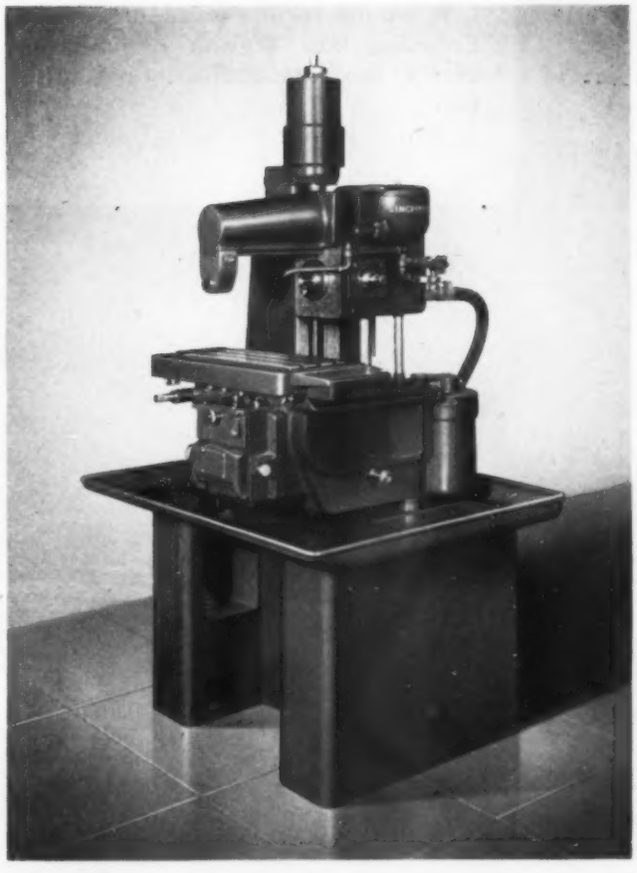
BUY CINCINNATI No. 0-8 PLAIN AUTOMATIC MILLING MACHINES

Today's production requirements demand machines that can be depended upon to give unfailing, continuous performance . . . machines with STAMINA.

You don't have to coddle CINCINNATI No. 0-8 Plain Automatic Milling Machines. They're built to "take it" and meet your production schedule even if it calls for practically continuous operation. They're versatile precision millers that are giving a good account of themselves in the war effort because they are completely automatic and capable of handling a wide range of small parts fast and accurately.

Equipped with automatic Rise and Fall Spindle Carrier, the No. 0-8 takes in its stride the production of many intricate parts necessary for wartime and peacetime requirements. And because of their ability to take obstruction jumps automatically, they are especially useful on jobs where it is not possible for the work to traverse directly into the cut.

We shall be glad to tell you about the many features of the CINCINNATI No. 0-8 and why they will be beneficial to you. Specification catalog M-964 covers this information. Send for your copy today.



Illustrated above is the CINCINNATI No. 0-8 Plain Automatic Milling Machine equipped with automatic Rise and Fall Spindle Carrier.

THE CINCINNATI MILLING MACHINE CO.

Cincinnati, Ohio U. S. A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES
SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

. . . How a Bullet T

Daniel Wesson was a dignified man. With a glance of approval at the cut of his coat in the glass, he donned his finest beaver hat. Only the utmost in fashion was befitting this occasion. For he was, he told himself, going to make history that day.

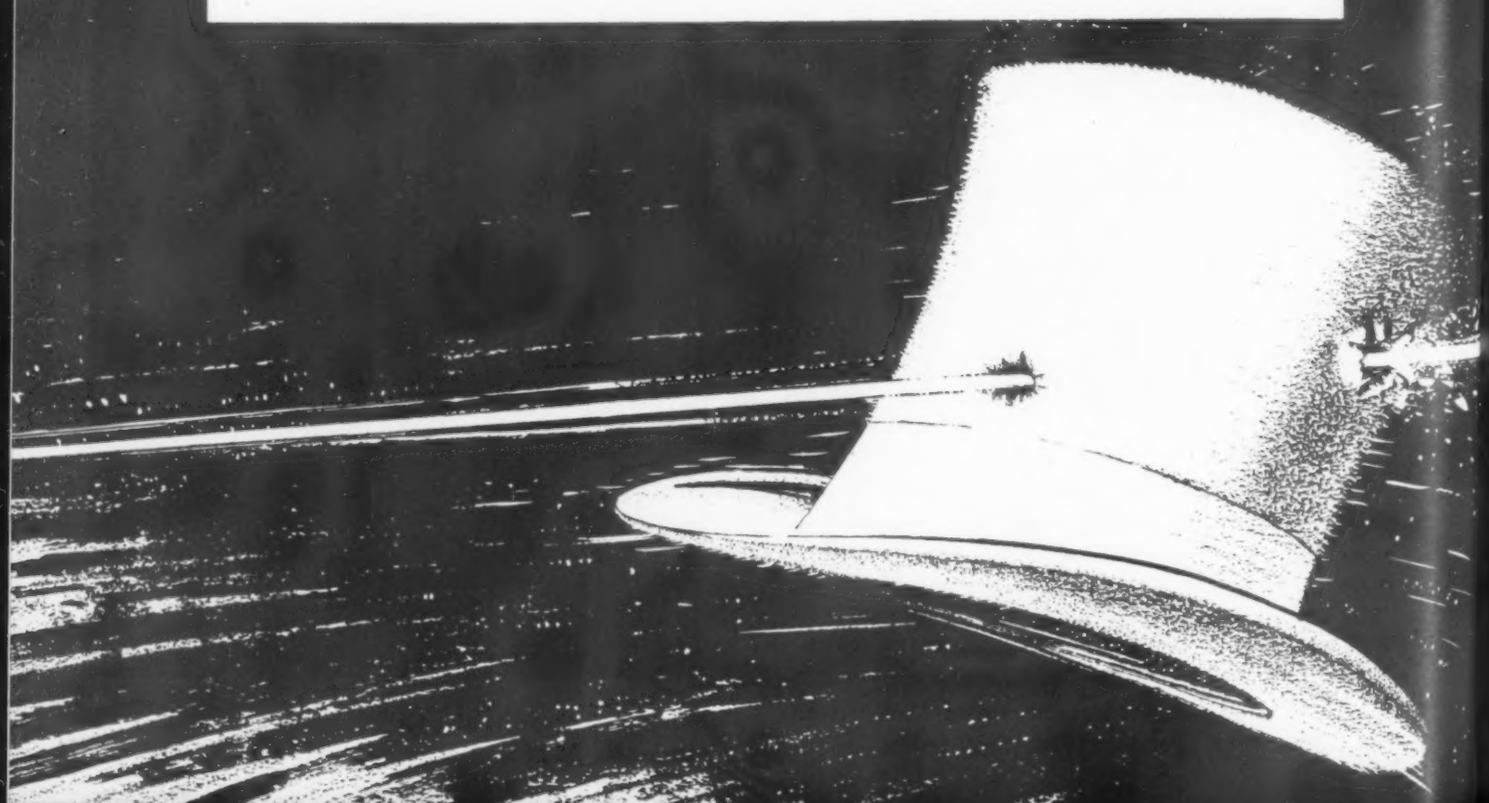
A Board of Ordnance Officers had assembled to witness the demonstration of an amazing new repeating firearm which Dan Wesson proposed to manufacture. The feature of this weapon was a revolving "turret" magazine in which the bullets were placed.

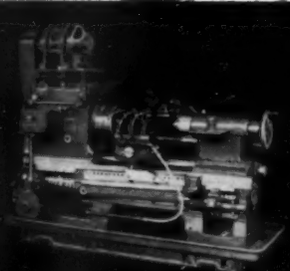
It would revolutionize the design of firearms, Dan Wesson declared as he gravely took aim at the door of a distant barn.

And in the next instant, Daniel Wesson achieved a unique distinction. He aimed at a barn door and put a bullet through the hat on his own head! For the explosion of the cartridge in the breech caused the one at the rear to explode at the same time.

"Amazing!" was the frigid exclamation of the Board. "We have but to provide our *enemies* with this remarkable weapon, and the battle is all but won!" And they departed with official disgust.

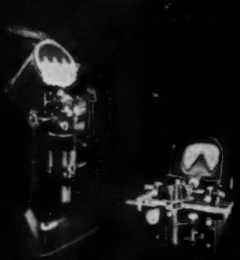
This ignominious little incident changed the destiny of two great industries. For Daniel Wesson turned his injured attention to a new principle of repeating guns — destined to revolutionize the firearms industry. And to manufacture parts for the new gun, the first commercial turret lathe was built — a basic contribution to machine tool design.





FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

et Through Dan Wesson's Hat Changed the Destiny of Two Great Industries

The first commercial turret lathe was developed by the old Robbins and Lawrence Company, from which the present Jones & Lamson Machine Company is directly descended.

By offering a new method for fast, precise and inexpensive manufacture of innumerable small parts, the turret lathe immediately became a basic industrial tool, and has played a conspicuous part in making possible this age of mass production.

It is significant that from the earliest plans handed down to Jones & Lamson, this company has constantly developed and improved the designs of turret lathes through more than a century . . . with the result that today, Jones & Lamson engineers are considered to be among the leading authorities in the world on problems involving the use of these and other related tools of industry.

Whether your company is large or small, your inquiries will receive the careful, detailed study of our staff of engineers.

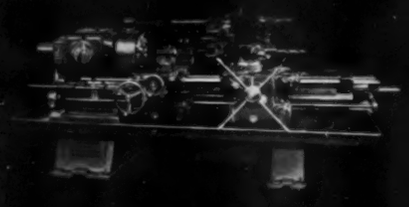
Write today and ask for our catalogs.

JONES & LAMSON
MACHINE COMPANY

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

Springfield, Vermont

U. S. A.

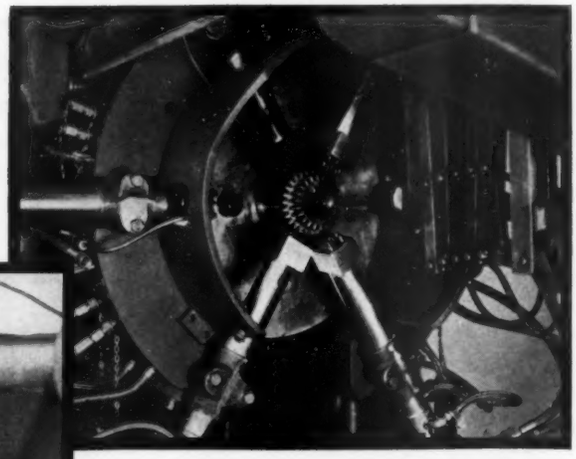


SADDLE TYPE
UNIVERSAL TURRET LATHE

PROFIT PRODUCING
MACHINE TOOLS

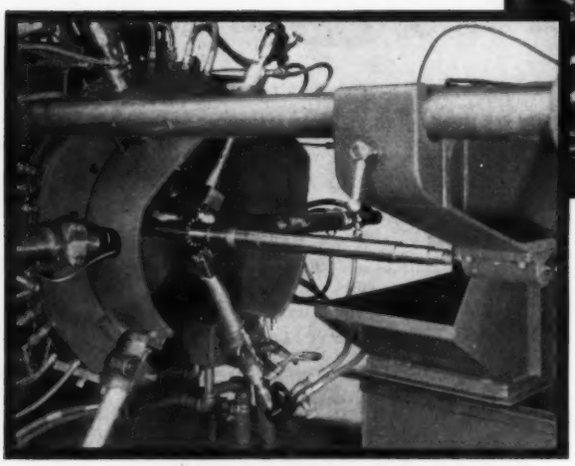
RAM TYPE
UNIVERSAL TURRET LATHE

EASE **OF FLAME**



CIRCULAR PARTS up to 10½ inches diameter

For gears and similar parts, the flame area can be of any desired width up to 2 inches on large-diameter parts, and 4 inches width where the diameter is 4 inches or less. Two, three, four or six torches are used, with the number of flame tips in use numbering up to fifteen in each torch.



ALSO FOR SHAFTS up to 36 inches in length

Heating can be localized at any point, the shaft being held between centers. Rotative speed is varied according to diameter of work and other requirements. Heating distortion is reduced to the absolute minimum.

FELLOWS

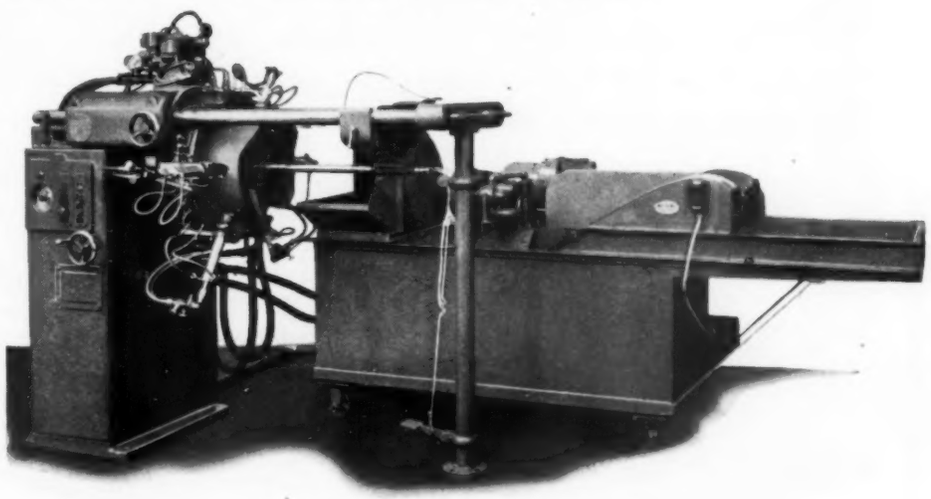
MACHINES AND TOOLS FOR GEAR PRODUCTION

HARDENING
OPENS UP New Possibilities

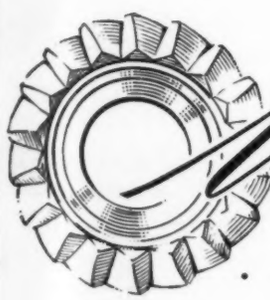
Flame hardening eliminates the necessity for designing parts to avoid distortion. It also makes possible the hardening of parts which otherwise would have to be used in the soft condition. The hardening of bearing surfaces on shafts, for instance, offers new opportunities for improved serviceability.

The Fellows Flame Hardening Machine is not confined to the hardening of gear teeth, and can be adapted to a large range of work. It will handle any part of a gear blank up to and including 10½ inches diameter, and can be applied to local hardening on shafts up to 36 inches in length.

The oxyacetylene flame is applied to the work while the latter is rotating at the desired speed. The entire periphery of the work is uniformly heated and to the desired depth. Once the proper heating time for any particular part has been obtained, duplicate results are assured by a time-control mechanism, which automatically shuts off the gas and stops the machine at the proper time. Further information on this controlled method of heating is available in a fully illustrated booklet which will be sent gratis upon request. Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, or 640 West Town Office Building, Chicago.



The Fellows Flame Hardener and Quenching Tank



Method

. . . . . FROM BLANK TO FINISHED GEAR

● Is your production being interrupted by grinding machine breakdowns? To eliminate costly "time out — waiting repair" periods, special attention has been given to that intangible quality — **STAMINA** — in the construction of **CINCINNATI** Hydraulic Universal Grinding Machines.

Every construction feature and element of manipulation has been designed and built to perform its function efficiently over long periods of time; to assure ease of operation and extreme accuracy; to give you Faster Set-up, Faster Handling, Faster Grinding, Faster Sizing, and to reduce maintenance to the point where it is scarcely a consideration.

For your toolroom grinding and general manufacturing work you can depend on Hydraulic Universals for continuous, failure-proof operation not only for the duration, but for many years after the war is over.

So, if it's **STAMINA** you want, buy **CINCINNATI** Hydraulic Universal Grinding Machines. Get all the facts. Send for Specification Catalogs G-486 and G-474 which give information on all features and their benefits.

IF IT'S *Stamina* YOU WANT

CINCINNATI Hydraulic Universal Grinding Machines are available in 12", 14", 16", and 18" swings; between center distances up to 72". Complete details are covered in Specification Catalogs G-486 and G-474. Write for copies today.

WIN *with a Cincinnati!*

BUY CINCINNATI HYDRAULIC UNIVERSAL GRINDING MACHINES

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

Cincinnati, Ohio U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES

VAN NORMAN
Milling Machines

VAN NORMAN

Directional Control of all Power Feeds, Simplifies Operation

OF VAN NORMAN MILLERS

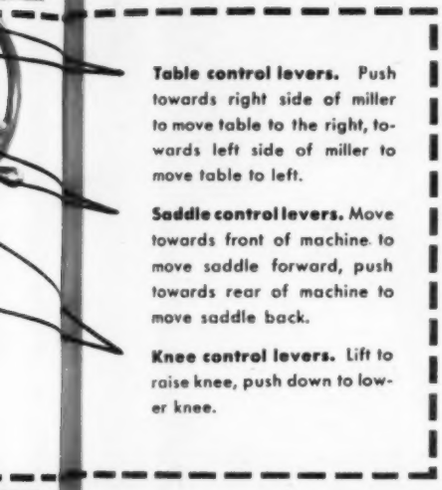


Table control levers. Push towards right side of miller to move table to the right, towards left side of miller to move table to left.

Saddle control levers. Move towards front of machine to move saddle forward, push towards rear of machine to move saddle back.

Knee control levers. Lift to raise knee, push down to lower knee.

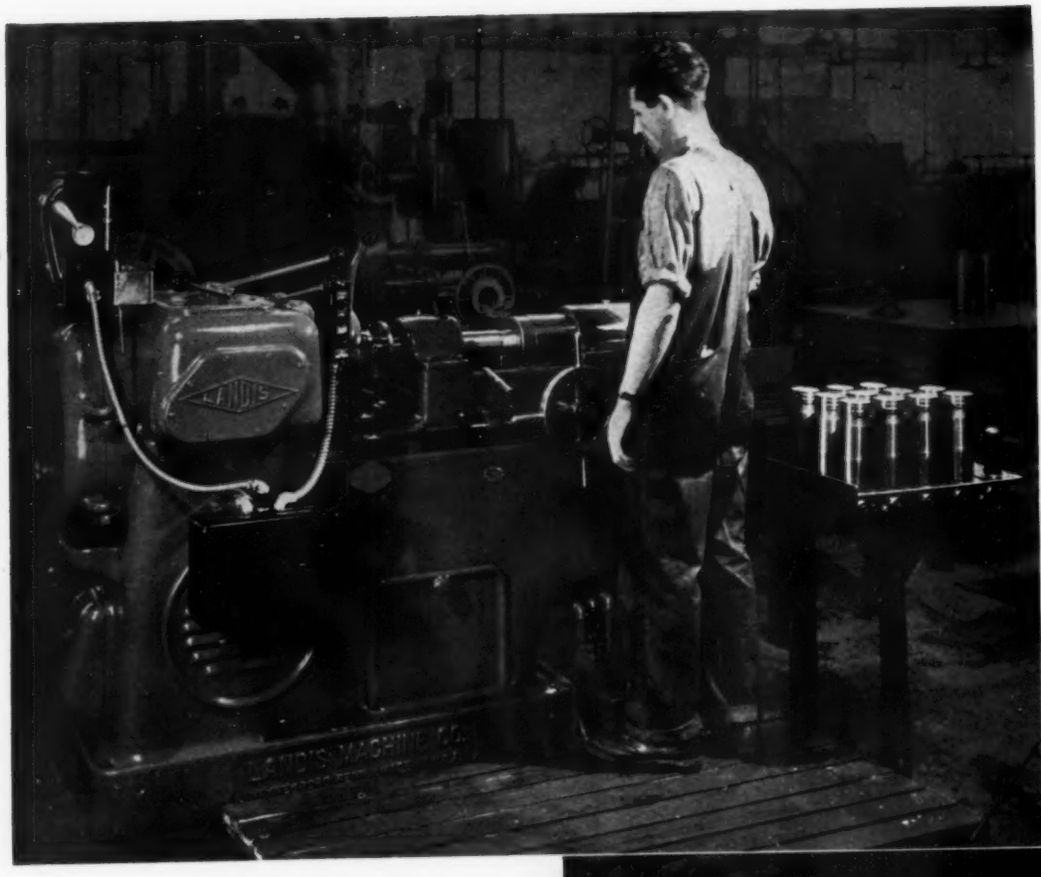
It is easy for the apprentice to learn and the skilled operator to remember that the table, knee and saddle of any Van Norman Miller travels in the same direction that the control levers are moved.

For example, if the operator is standing in front or rear of the machine and wishes to move the table to the right, he moves the table control lever to the *right*, if he wants to raise the knee, he *lifts* the control lever for the knee, if he wants to lower the knee, he pushes this same lever *down*.

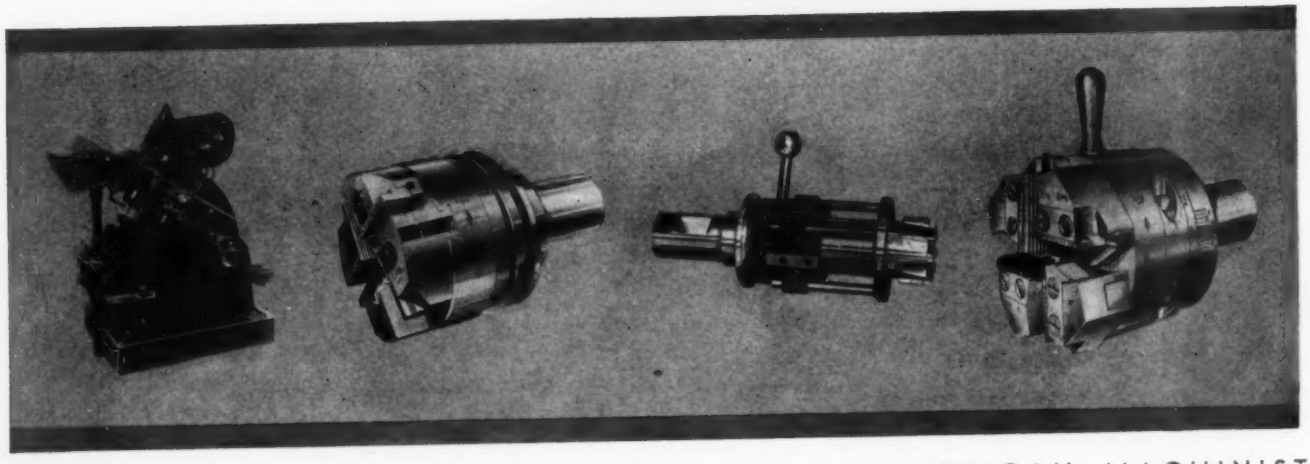
From *either front or rear*, the operator has complete directional control of *all* power feeds,—simple, practical and time-saving. Add to this feature, the front and rear control of feed selection by a single lever, as well as front and rear control of 6-way power rapid traverse and you will see why operators prefer Van Norman Millers.

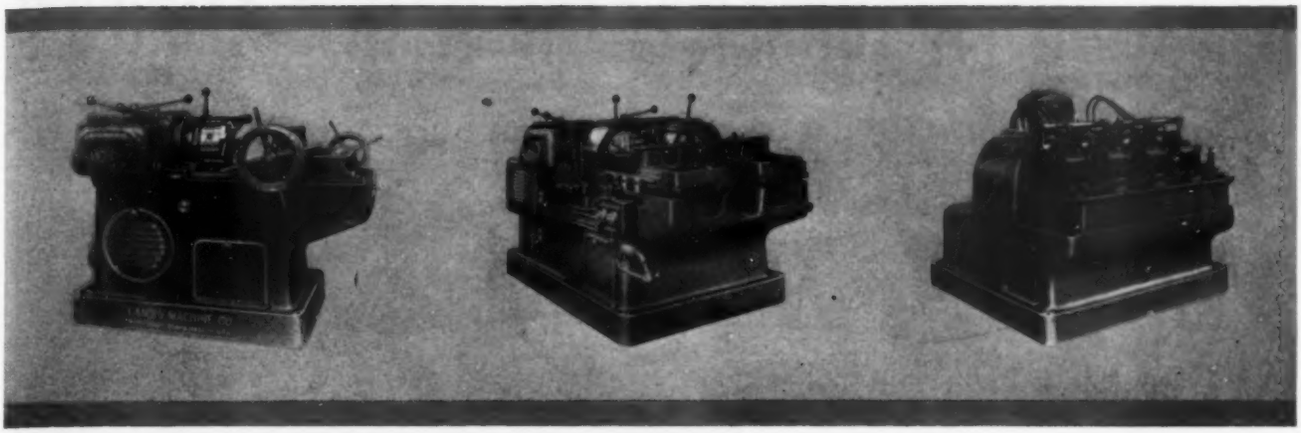
The "finish" of Van Norman Milling Machines is in accordance with the requirements of the War Production Board.

MACHINE TOOL CO., SPRINGFIELD, MASS.



BE THREADWISE
LANDISIZE





Modern Tools for the National Emergency

—In Threading it's LANDIS—LANDMACO

1½R Shell Tappers and LANDMACO Threading Machines are used by almost every manufacturer for handling the threading of munitions components. These machines will handle difficult thread cutting operations on an unusually high production basis with assured Thread Accuracy.

The increased demand for More production requires machines which are capable of producing **more**—with minimum rejections, and at lowest possible cost — Investigate the LANDMACO as applicable to your Threading requirements — Write for Bulletin No. H-75.

The LANDIS Line

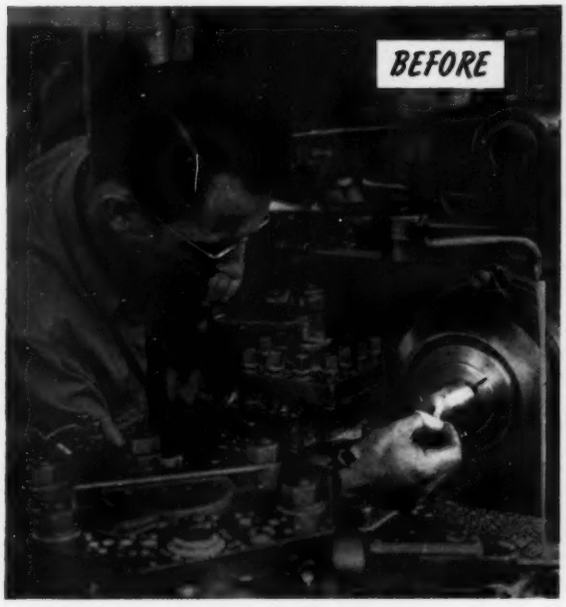
STANDARD THREADING MACHINES
LANDMACO THREADING MACHINES
BOLT FACTORY THREADERS
AUTOMATIC FORMING AND THREADING MACHINES
PIPE THREADING AND CUTTING MACHINES
PIPE AND NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS
CHASER GRINDERS
ROTARY BOLT THREADING DIE HEADS
STATIONARY PIPE DIE HEADS
LANDMATIC HEADS FOR TURRET LATHES
LANDEX HEADS FOR AUTOMATIC SCREW MACHINES
LANCO HEADS FOR HAND-OPERATED THREADING MACHINES
LANDIS COLLAPSIBLE AND ADJUSTABLE TAPS

—and the LANDIS Precision THREAD GRINDER

LANDIS MACHINE COMPANY, Waynesboro Pennsylvania

EVER LIGHT A TURRET LATHE WITH MATCHES?

That's what Walter Rabel had to do before they put in G-E Fluorescent Lighting!



WALTER RABEL turns gear blanks on a turret lathe in one of the nation's vitally important subcontract shops. Where he works they make many types of gears—the largest for a big Diesel engine is 19 inches across; the smallest is for an airplane windshield wiper.

BEFORE G-E FLUORESCENT LIGHTING was installed he had to light matches—even in the daytime—to see into the bore to make sure that the cutting tool was properly adjusted. Now with fluorescent lighting, the light is so well distributed that he can see the operation much more easily and quickly.

BECAUSE GEAR MAKING is a precise job done to tolerances as close as one ten-thousandth of an inch, the slightest flaw or imperfection in the teeth of a gear means a reject. With the former lighting considerable time was lost taking the micrometer to the window for reading. Now this is unnecessary.

IF YOUR SHOP NEEDS better lighting for war work and you have a suitable WPB priority rating, ask your G-E lamp supplier about installing fluorescent lighting in certified fixtures with G-E MAZDA F (fluorescent) lamps . . . the kind that are *made to stay brighter longer* and that provide cool, efficient "indoor daylight" 24 hours a day.

IF YOU CAN'T INSTALL better lighting now, you can make your present lighting do a better job by doing such things as:

1 Use soap and water . . . on a *regular* cleaning schedule.

2 Right size bulbs in present fixtures.

3 Relocation of present lighting to fit new demands.

4 Supplementary lighting for the most critical seeing operations, such as inspections.

5 Light-colored walls to reduce light absorption; light-colored finishes on machinery to increase visibility.

6 Frequent light meter checks on maintenance.

For further details, see your G-E lamp supplier.

G-E MAZDA LAMPS

GENERAL ELECTRIC

ARMSTRONG

STOP WASTING HIGH SPEED STEEL IN FORGED TOOLS

See that in your plant no valuable high speed steel is wasted—is used for "solid" forged tools when the same high speed steel used as cutter bits in ARMSTRONG TOOL HOLDERS would go ten times as far. Always more efficient than forged tools ARMSTRONG TOOL HOLDERS are essential under war conditions for *all* standard operations on lathes, planers, slotters and shapers, to save man-hours, to save machine-hours and to save high speed steel.

ARMSTRONG TOOL HOLDERS save man-hours by eliminating all forging of tools and reducing tool grinding 70%. They save machine-hours by ending delays waiting for tools and by permitting far higher speed and heavier feeds. They save high speed steel by making every ounce do the work that would require a pound of high speed steel in a bar tool. Be sure you are using ARMSTRONG TOOL HOLDERS on every possible operation—they come in over 250 sizes and shapes.

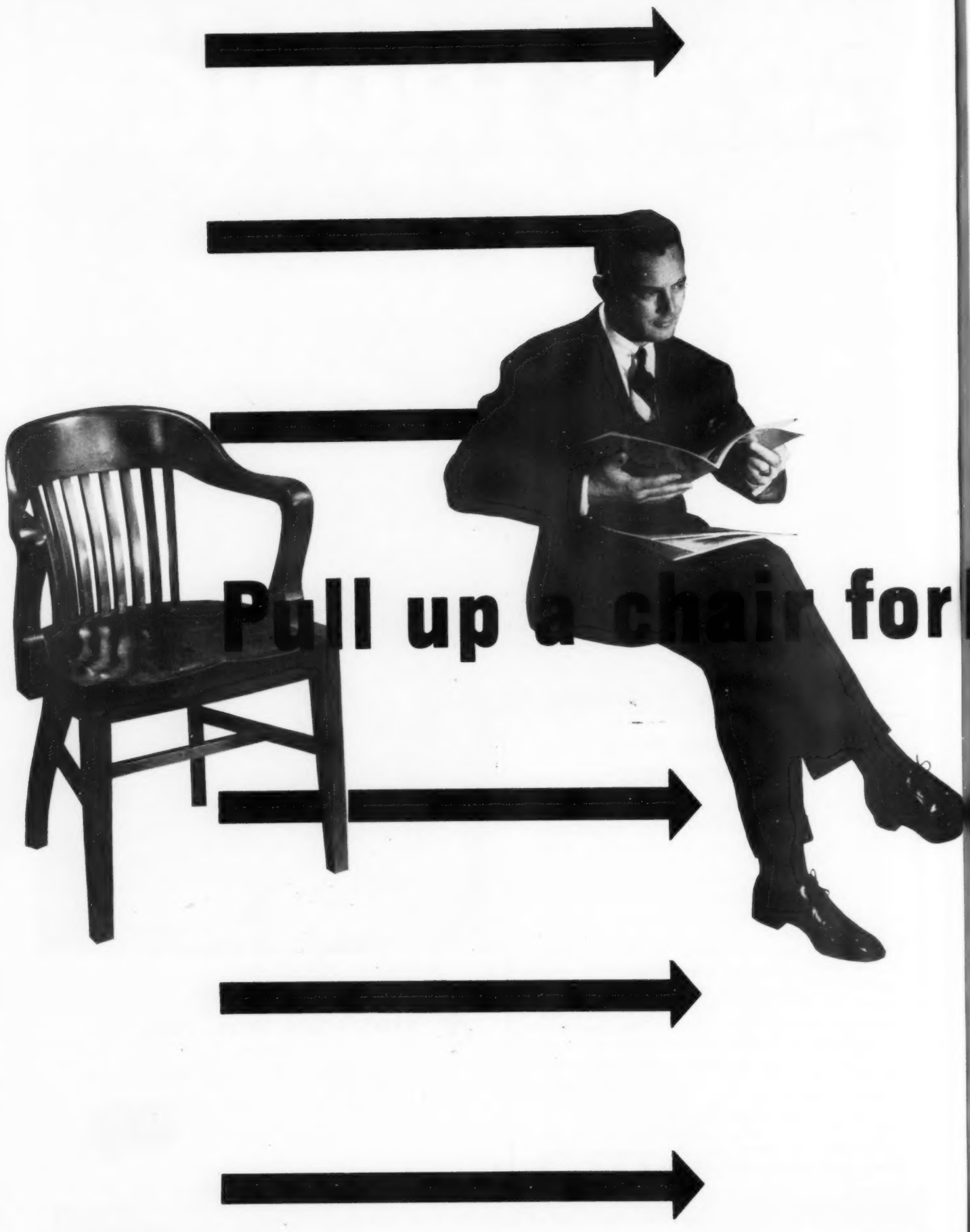
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. FRANCISCO AVE. CHICAGO, U. S. A.

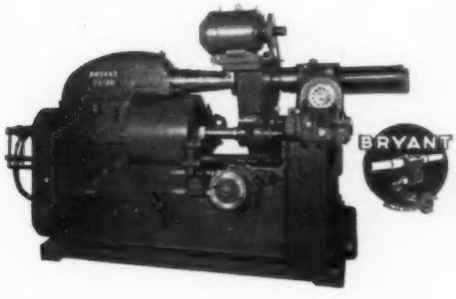
Eastern Warehouse and Sales:
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms


Pull up a chair for B

r Bryant

WHEN your desk is snowed under with problems, production plans and blueprints, pull up a chair for Bryant. Every phase of a new job that relates to internal grinding is a phase that interests Bryant. Every angle and opportunity whereby time, money, stock or operations can be saved on these phases is a chance for Bryant to help you.



Bryant productive capacity has already been trebled and is constantly increasing to aid defense production. Bryant engineering service has also been stepped up — stepped up not only to meet the urgent needs of armament, but the equally vital problem of planning new products that can be made economically and sold at a profit when peace returns once more.

This is an added reason for the forward-looking executive to "pull up a chair for Bryant."

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Simplex Milwaukee Milling Machine—a compact, medium size machine for efficient production of smaller parts.

The machine tool industry has established new records in war production by producing machines in quantities without sacrificing accuracy and quality . . . Kearney & Trecker has developed many such machines, among them the M-Series Simplex—the newest machine in the bed type field.

It answers the demand for a medium-sized machine to efficiently produce the thousands of small parts vitally needed for planes, tanks and guns. Because its basic design is the same as the larger machines, it has strength and ruggedness to spare.

Milwaukee MACHINE

It's yours for the asking

"THE PROPER CARE OF MILLING MACHINE ARBORS"

So many of our customers have told us that the Kearney & Trecker arbor booklet provided the answer *to getting the utmost out of their present milling machines* — we'd like you to have a copy of it!

It tells how to —

1. Prolong Arbor Life
2. Maintain Precision and Trueness
3. Detect Distortion and Springing
4. Reduce Maintenance Costs
5. Secure Maximum Milling Efficiency

The back cover carries a SPEED CHART which can be cut out and placed next to the machine. It will show you at a glance what cutters to use on various materials, and the recommended speeds and feeds. For your copy write — Department AJ, Kearney & Trecker Corporation.

★ *Attention Educational Departments*

Are you faced with the problem of training milling machine operators? If so, we have the answer for you.

Kearney & Trecker has just completed a new visual training course titled "Milling Practice." It is composed of five, half-hour sound slide films dealing with the fundamental principles of milling for good machine tool performance.

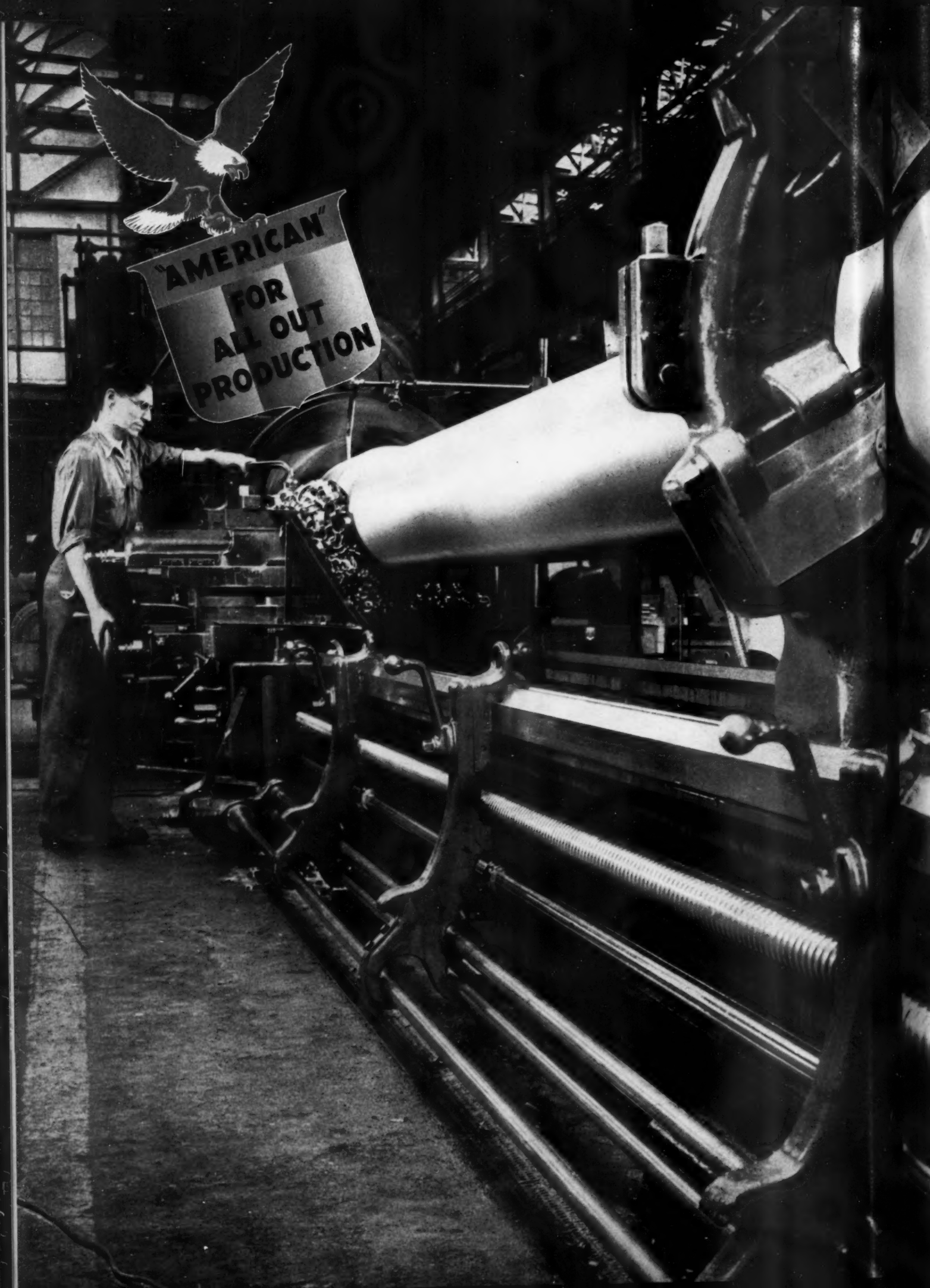
You may obtain it on a rental basis or purchase it outright. Those firms who have seen "Milling Practice" acclaim it to be the best of its kind ever offered to industry. For further details write . . . The Department of Industrial Education, Kearney & Trecker Corporation.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN, U. S. A.

To help you produce and deliver more—to aid you in getting the most efficient results out of tools and materials — we will offer from time to time, useful information in printed form on milling machine operation. This is intended mainly for those of your men who are not so familiar with these facts.

KEARNEY & TRECKER
CORPORATION

T O O L S


"AMERICAN"
FOR
ALL OUT
PRODUCTION

MIGHTY LATHES *Turn* MIGHTY SHAFTS *for* THE U.S. NAVY

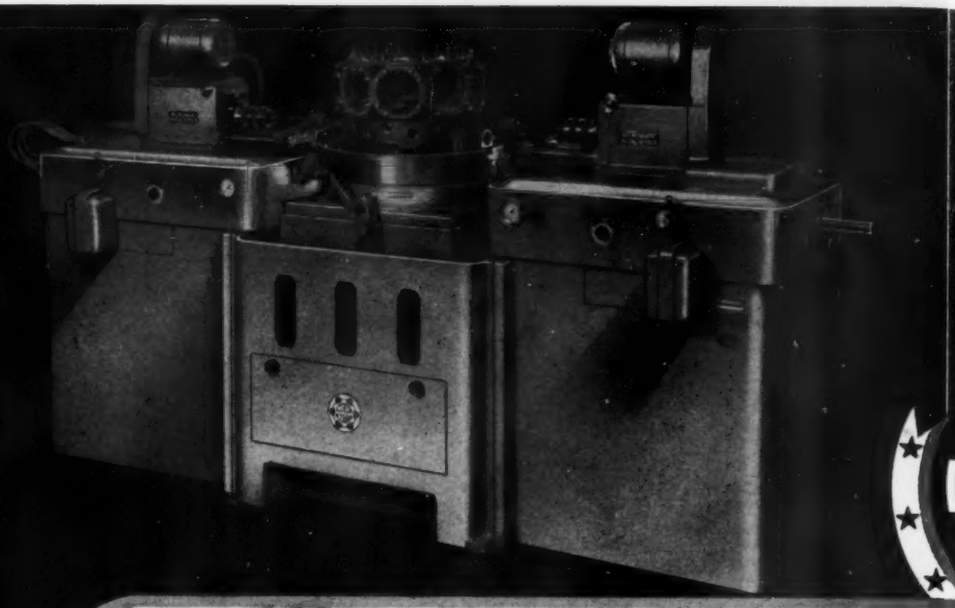
"AMERICAN" 48" Lathes, both in Navy Yards and Contractors' Plants, are adding their enormous power and productive capacity to the building of our "two-ocean" Navy.

"AMERICAN" Lathes, from 14" to 48" sizes, are fast—powerful—accurate. They are meeting the challenge of War demands like all true AMERICANS.

THE AMERICAN TOOL WORKS COMPANY

Lathes - Radials - Shapers

CINCINNATI, OHIO, U. S. A.



Honing valve guides after assembly in crankcase (Radial Aircraft Engine) on Double End Hydrohoner with Micr-O-Size control — production 3 to 6 complete assemblies per hour — removes average of .0005" to .001" stock per bore — generates uniform size within .0003" to .0005", accuracy within .0001" to .0003" and surface finish within 3 to 5 micro-inches, r.m.s.

AIRCRAFT···—

FOR VICTORY PRODUCTION

SAVE TIME

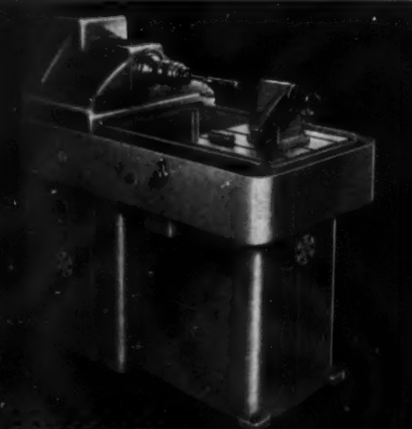
SAVE METAL

SAVE COST

IMPROVE QUALITY

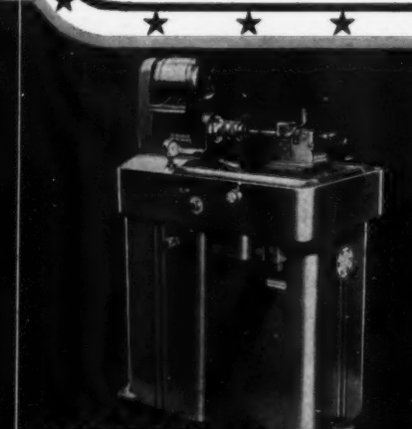
AIRCRAFT···—

Feathering Oil Pump Gear Teeth (Aircraft Engine) external honing.



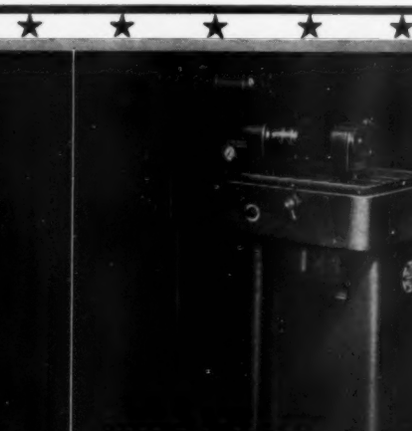
AIRCRAFT···—

Honing Piston Pin Bores (Aircraft Engine).



AIRCRAFT···—

Honing Valve Guides (Aircraft Engine) before assembly.



HYDRAULICS···—

Honing O.D. of pistons for a variable delivery pump.

Honing cast iron valve guides on full automatic Hydrohoner with Micr-O-Size control—Production 250 pieces per hour. Average Stock removed, .0015" to .0025"—Size within .0005" tolerance; accuracy within .0001" to .0002"; surface finish within 3 to 5 microinches, r.m.s.

Honing Piston Pin holes (in Piston) on Double Spindle Hydrohoner with Micr-O-Size control.

AUTOMOTIVE···—

Microhoning has been adopted in most armament production shops to speed up the final processing operation on vital bearing surfaces.

Microhoning generates final surfaces with the minimum amount of stock removal.

Microhoning saves sufficient processing time and cost in some installations, it is reported—even *to pay for the machine in 30 to 40 operating days.*

Microhoning controls cutting pressure, speed and motion to produce maximum obtainable quality of generated surfaces.

Write for Bulletins AR60 and AR64 for further details.

PHONE DETROIT
TRINITY 1-1300

MICROMATIC HONE CORPORATION

1345 E. MILWAUKEE AVE. DETROIT, MICHIGAN

ORDNANCE···—

Double Spindle Hydrohoner with Micr-O-Size control for honing gun charger tube bores.

HYDRAULICS···—

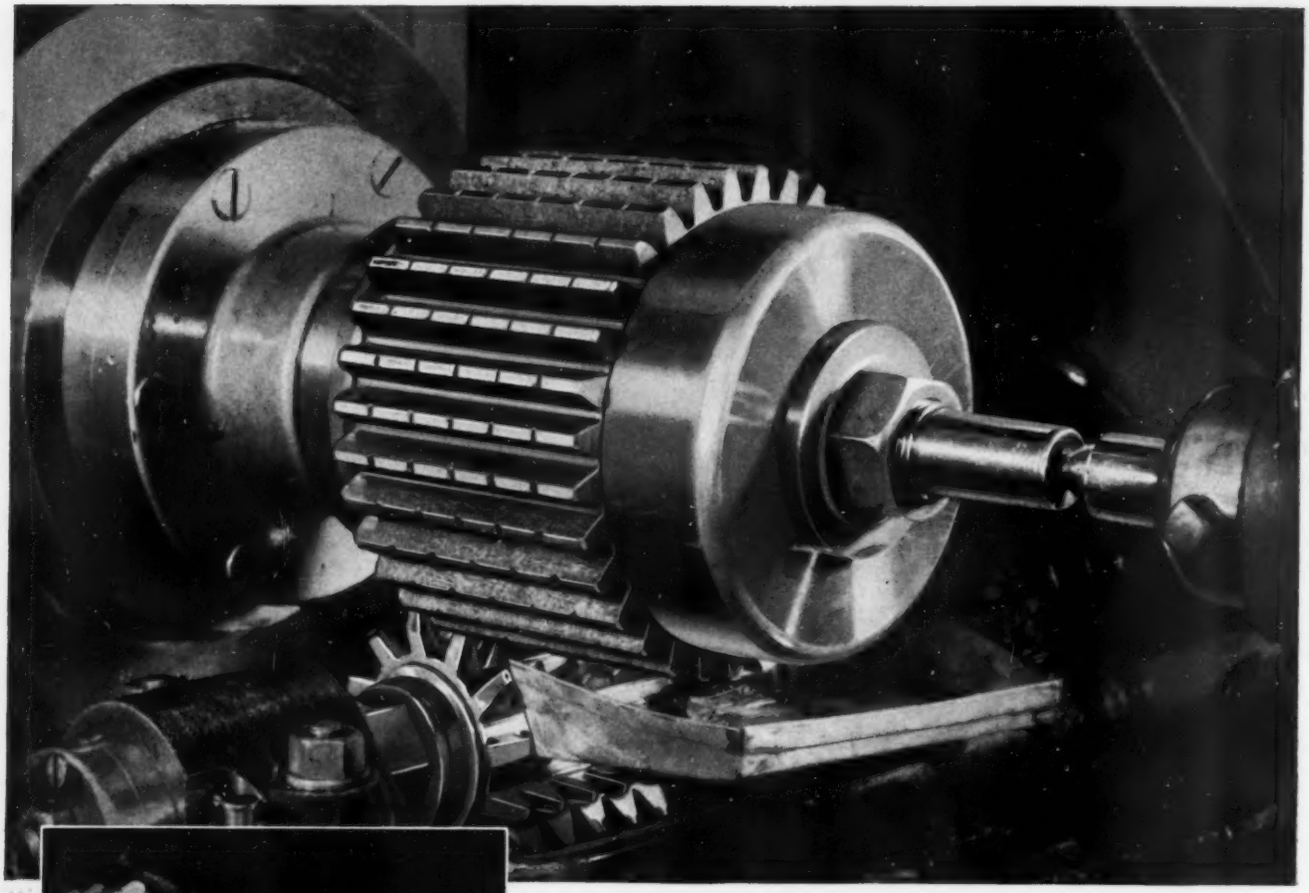
Honing blind end bores in a variable delivery pump body.

HYDRAULICS···—

Honing bores in hydraulic valve body on Micromatic Hydrohoner.

ORDNANCE···—

Honing pinion shaft bores in hardened planetary gear for military vehicle.



.0002" RUNOUT...

BARBER-COLMAN HOBBING MACHINES HOLD CLOSE LIMITS ON A TOUGH JOB

SUCCESSFUL hobbing, on a production basis, of these tractor transmission fourth-speed ring gears is an excellent demonstration of the inherent over-all accuracy of Barber-Colman Hobbing Machines. With exceptionally close concentricity requirements, large arbors, ground for a snug fit on the inside diameter of the gear blanks and having outer center supports, were used. But, without accurate machines to drive them, these high-precision work-holders would have been wasted. Barber-Colman standard type "A" and type "D" Hobbing Machines successfully filled the bill, the only change being the addition of an auxiliary coolant pump, delivering up to 25 g.p.m.

PRODUCTION DATA FOR THIS GEAR

Size of work — 6.8" O.D., 3/4" face, 32 teeth, 5 pitch, 20° P.A., depth of cut .460".

Material — SAE 4620 steel, 160-175 Brinell.

Accuracy Required — to be within .0002" of runout on pitch line.

Load — 6 blanks, on snug-fitting arbor with outer center support.

Hob — 4" x 4" x 1-1/4" taper hole, single thread, ground.

Machine Set-up — hob speed 174 r.p.m., feed .045" per rev. of work, conventional cut.

Production — 27 min. floor-to-floor, per load of 6 pieces.

Hob Life — 12 pieces per setting, 7 settings, 84 pieces per grind.

WE WANT TO HELP YOU

Barber-Colman Company stands ready to help you toward achieving the greatest possible production capacity, or accuracy or both, from your machines. Call your B-C representative as his practical experience may quickly lead the way to unsuspected opportunities for worth-while gains.

BARBER B-C COLMAN PRODUCTS

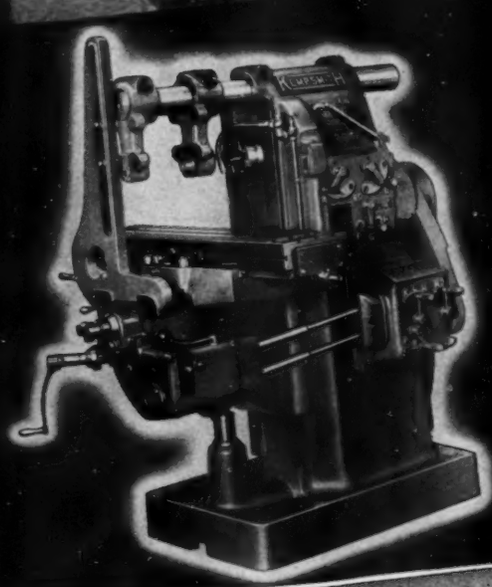
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

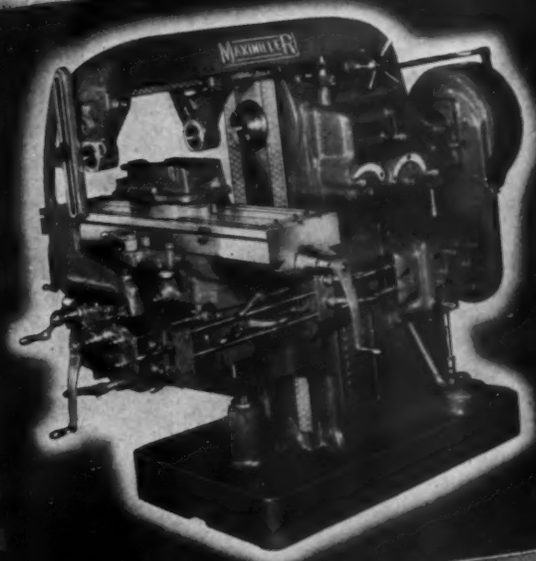
BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

OK WPB and INDUSTRY Full Speed Ahead FOR PRODUCTION NOW!

Suddenly the 40-hour week i[illegible] tion *every week* thr[illegible] calls for super-qual[illegible] veterans, thoroughly [illegible] tion work. They ha[illegible] industry th[illegible] cision under heavy c[illegible] and feeds, they [illegible] for victory in many vital war industries. You can p[illegible] for full speed ahead, for PRODUCTION NOW!





KEMPSMITH
TYPE "G" MILLER
...**"brother" of the famous KEMPSMITH MAXIMILLER**

KEMPSMITH
MAXIMILLER
...**built to speed up production on "3-shift" schedules**

PRECISION
MILLING MACHINERY
Experience SINCE 1888
KEMPSMITH MACHINE CO.
MILWAUKEE • WISCONSIN

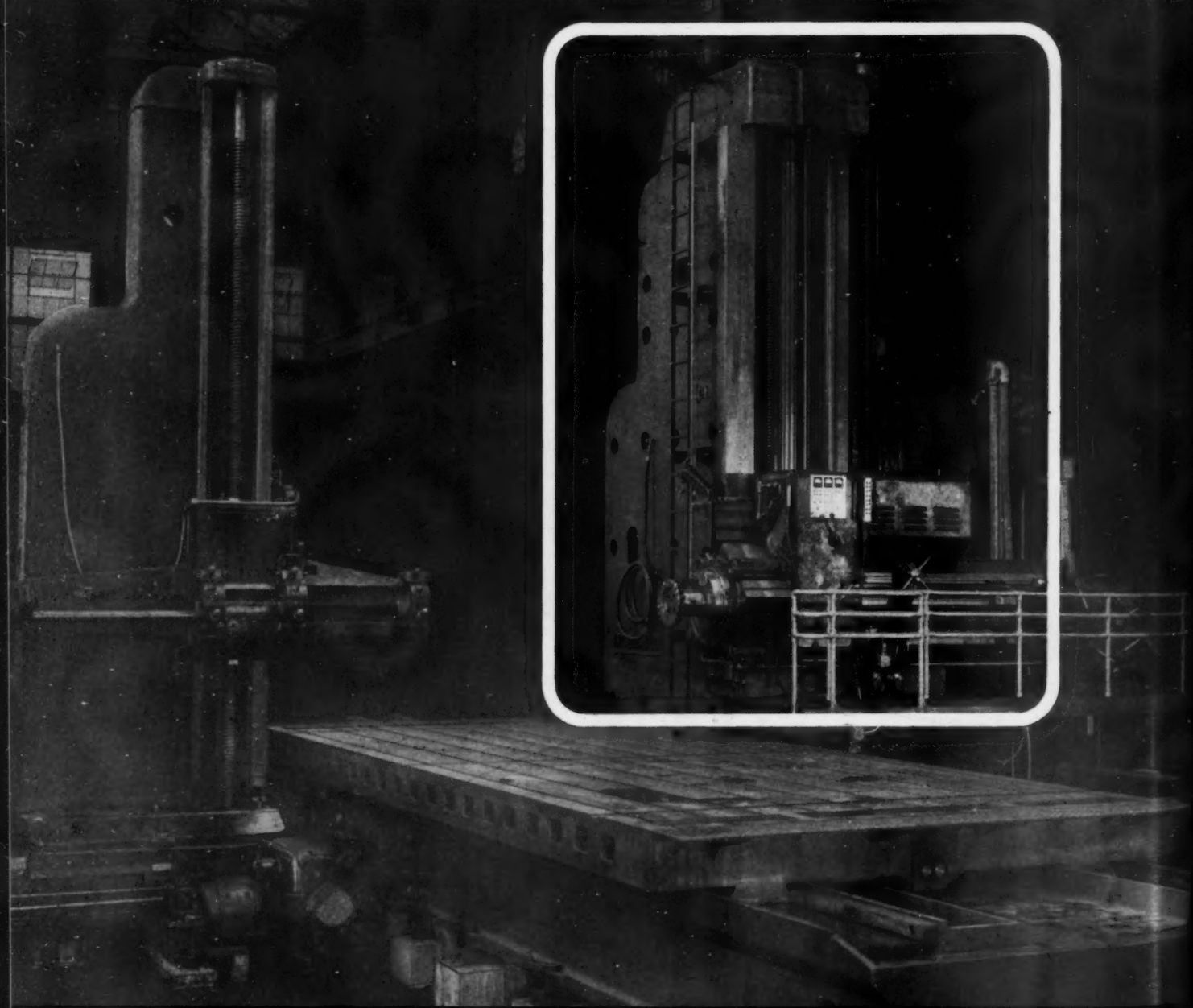
HOW TO DO **BIG MILLING JOBS**

One of the most vexing problems of manufacturing war goods today is how to *mill* a large casting on several surfaces.

The popular approach to this problem has been with the 6", 7", or 8" bar-type *Milling, Boring, Drilling* and *Tapping* Openside machines, as illustrated below.

Our efforts to meet this problem with *less machinery* resulted in the design of the Ingersoll Traveling Housing Openside machine shown on the opposite page. It is a design that isolates the *milling component* of these large machines and permits you to *mill* the largest castings with *equal rigidity* and at *heavier* feed rates. It is also used for occasional boring operations by means of a 20" horizontal quill feed, this being an optional feature.

Thus, if your job is *predominately milling*, you do not need all the equipment that goes into a bar-type machine. At a time when metals and minutes mean so much, this machine saves both vital material and labor hours — and greatly reduces your capital investment.



T H E I N G E R S O L L M I L L I N G

WITH LESS MACHINERY

MACHINE DATA . . .

CAPACITY — 72" vertical travel and 6' horizontal travel.

HOUSING — L-type rigid construction, 24" wide across the ways. Height permits 72" vertical travel of the head. Housing travels 6 ft. longitudinally on a bed parallel to a work-holding bed plate or stationary table.

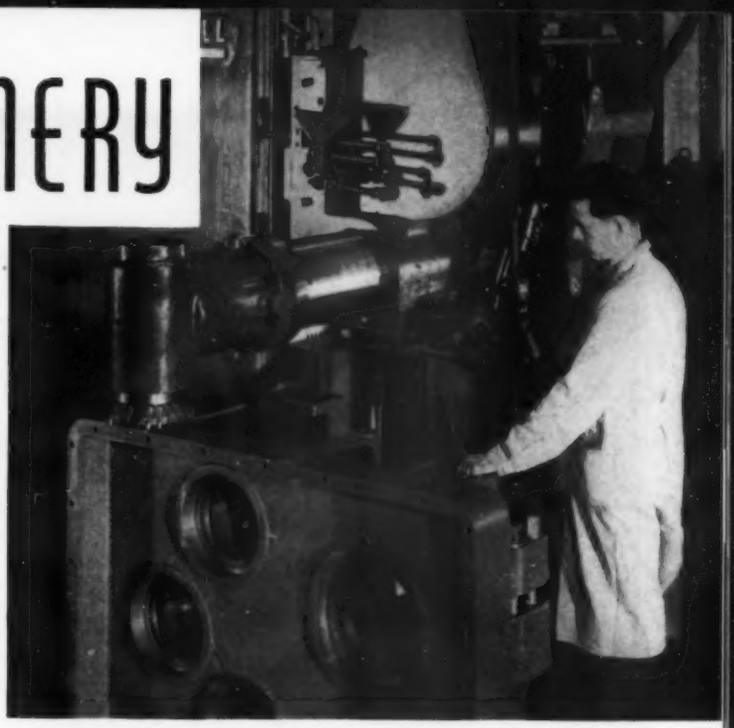
HEAD — 10 H.P. direct motor driven milling and boring head, with 72" vertical feed and traverse on the housing.

SPINDLE & QUILL — The 11¼" dia. quill carries the 6" dia. spindle. Quill has an optional 20 inches transverse power feed and rapid traverse.

SPINDLE SPEEDS — From 8 to 70 R.P.M.

FEED RATES — The Housing and the Head feeds range from 3/16 to 9½ inches per minute and rapid traverse at 6 feet a minute. The quill feeds at 1/16 to 3¼ inches a minute, rapid traverse rate being 2 feet a minute.

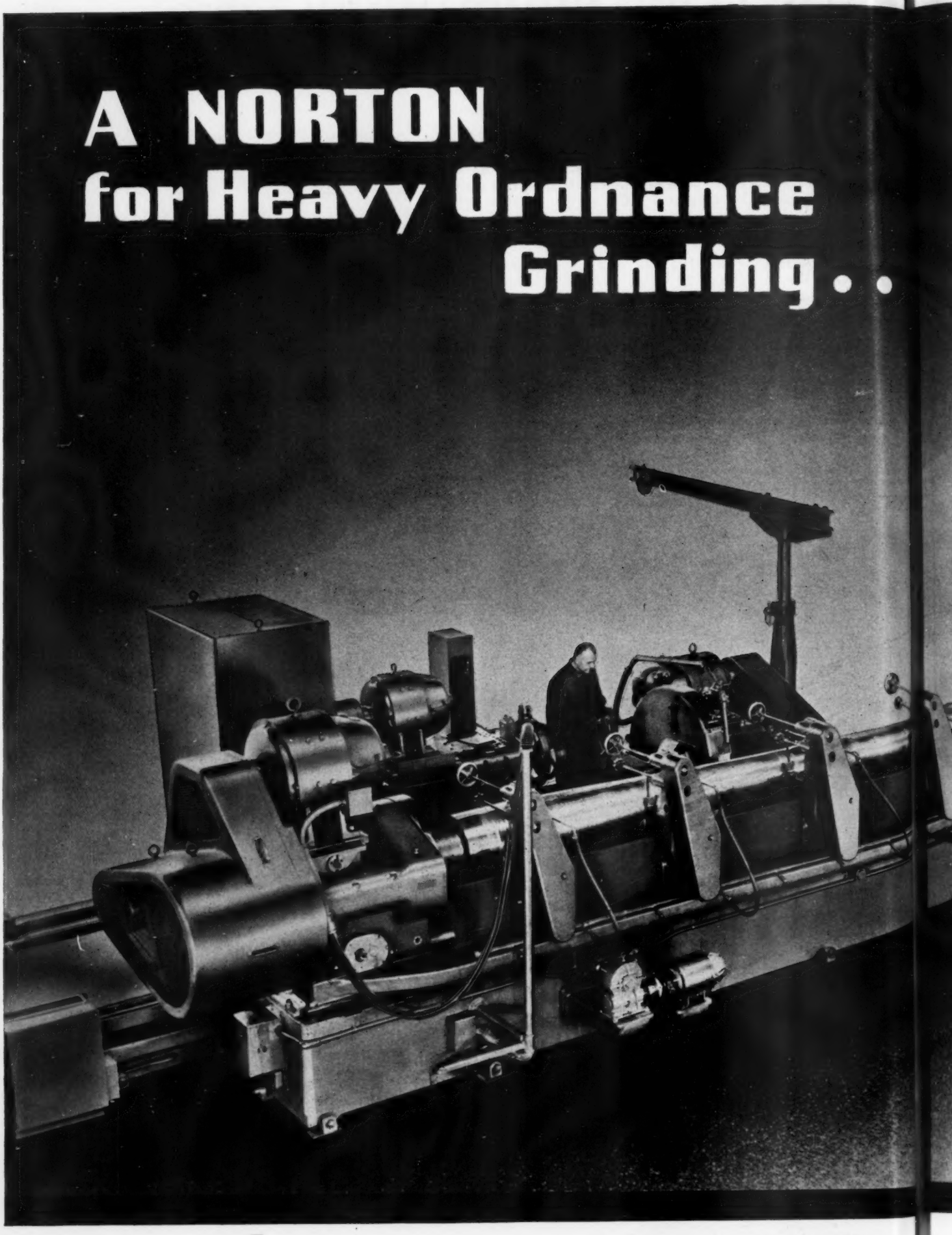
CONTROL — From portable pendant station and selectors. Variations in speeds and feeds are obtained by hand rheostats.



The Right Angle Attachment may be secured to the end of the spindle in four different positions. This permits milling in several planes without changing the set-up of the work piece.

MACHINE CO., ROCKFORD, ILL.

A NORTON for Heavy Ordnance Grinding . .



Developed Especially for the Big Jobs . .
THE REALLY BIG ONES!

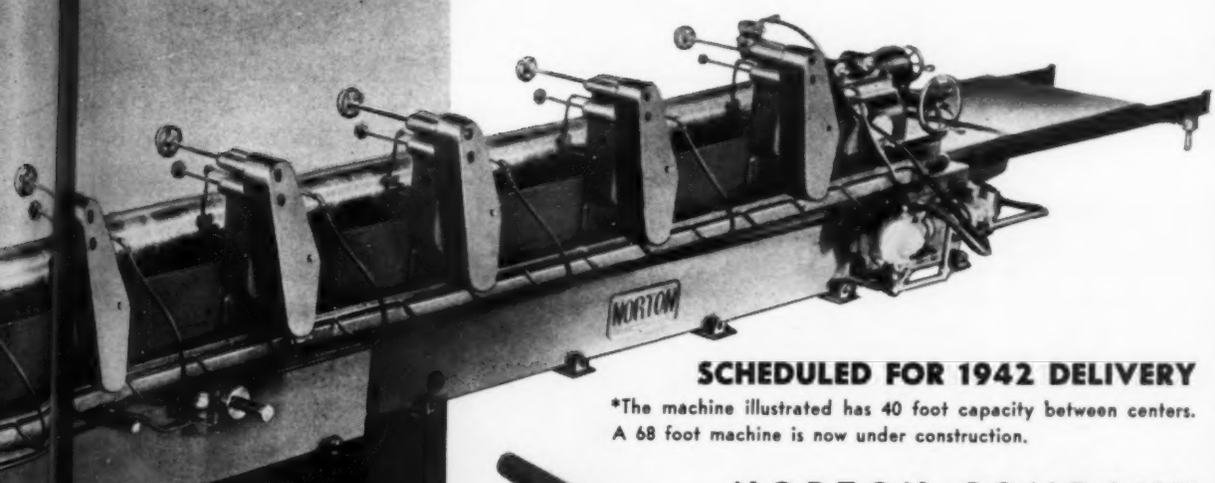
A cylindrical grinder of the traveling wheel type.
For heavy ordnance components, turbine shafts and other large cylindrical work.

A powerful roughing machine and an accurate producer of fine finishes.

Furnished in 20, 24, 26 and 36 foot capacity between centers.*
Weighs from 120,000 to 185,000 pounds.

Grinds straight or taper diameters.

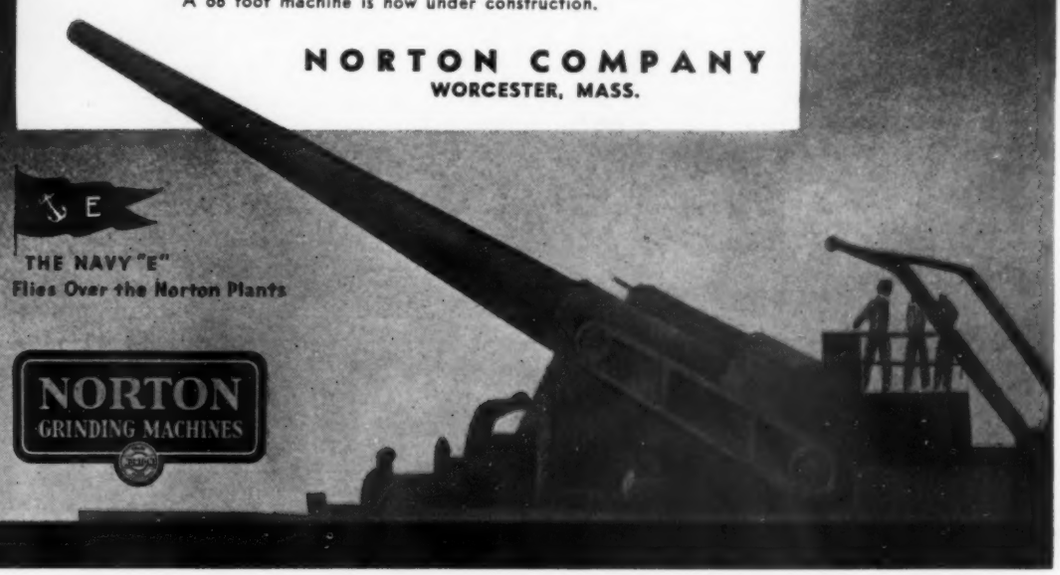
Operator rides on long traveling wheel carriage. Can make any adjustment or stop any unit without taking a step.



SCHEDULED FOR 1942 DELIVERY

*The machine illustrated has 40 foot capacity between centers. A 68 foot machine is now under construction.

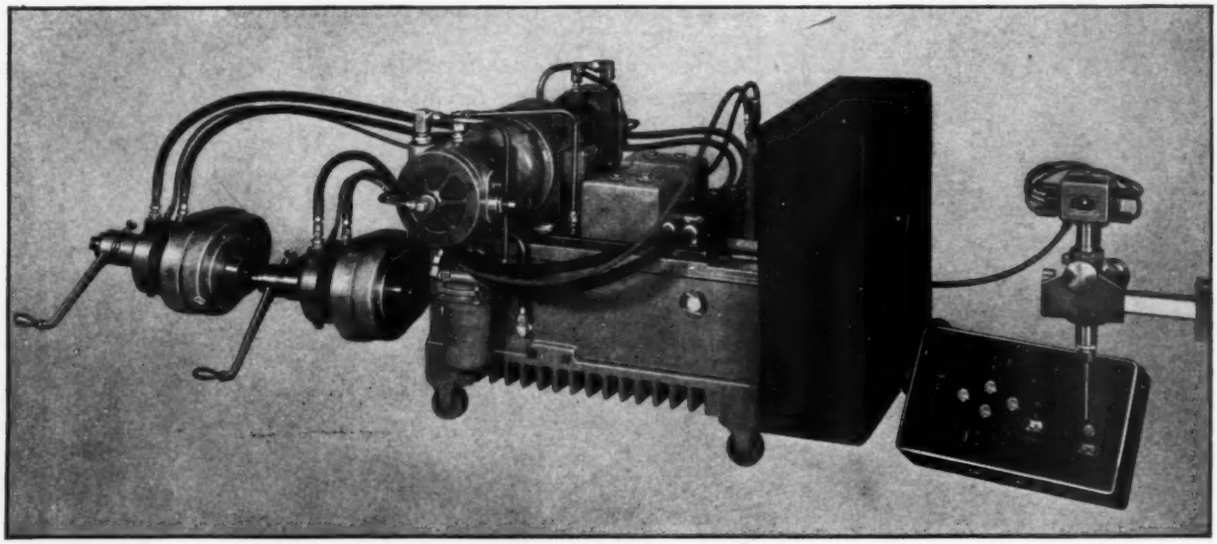
NORTON COMPANY
WORCESTER, MASS.



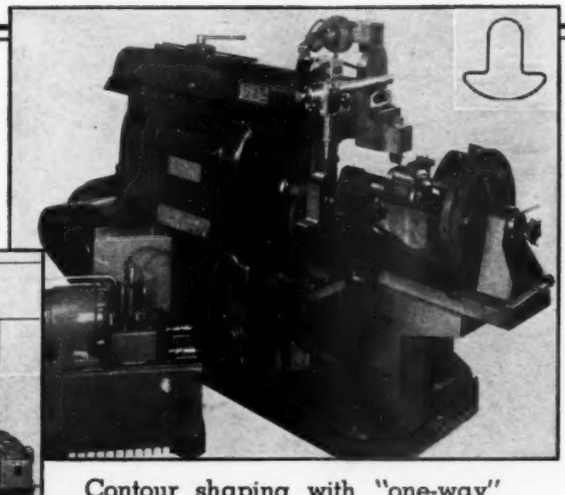
THE NAVY "E"
Flies Over the Norton Plants

NORTON
GRINDING MACHINES

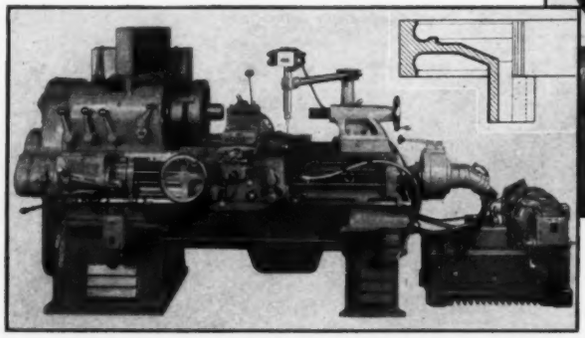
Automatic



The portability of the DUPLIMATIC allows for fast conversion to war work. The same interchangeable feature will permit rapid "re-conversion" to peacetime production.



Contour Turning—semi-automatic set-up—with a dual DUPLIMATIC. This is war work. It was gotten under way without long waiting. It will have many peace time applications.



Contour shaping with "one-way" DUPLIMATIC uses machine cross feed. Tool feed is entirely automatic and very accurate.

Do Your Contour Machining with a DUPLIMATIC

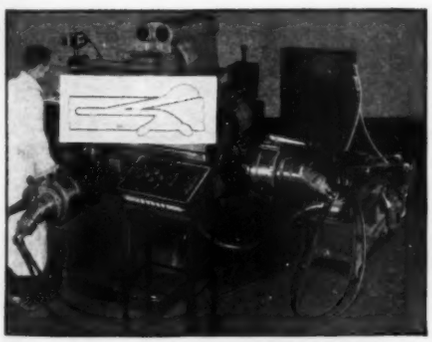
Contour Machining

Standard WITH YOUR OWN TOOLS

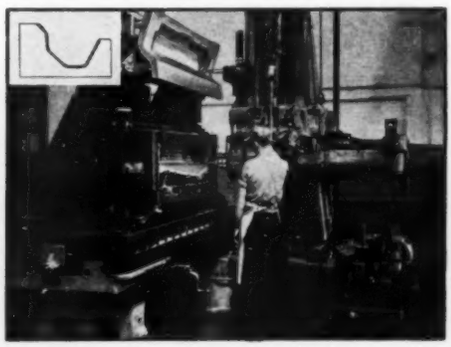
Ordinary engine or turret lathes, vertical mills, shapers, boring mills, have been put on full-automatic production machining with DUPLIMATICS. No special skill is needed to operate them. Newly trained men can readily exceed the speeds and accuracies possible with manually controlled machine tools with the DUPLIMATIC.

DUPLIMATICS are connected with one, two or three feed screws—depending on the work. A master pattern or template is duplicated directly and *automatically* in metal.

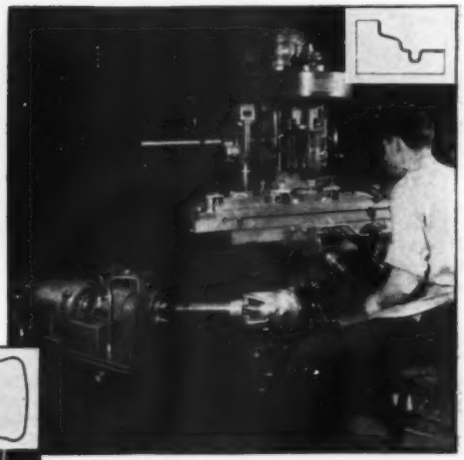
Full information on request. Please send complete details of work.



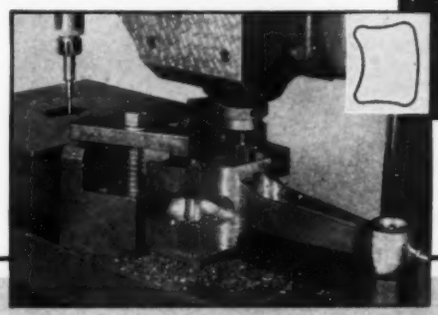
Milling along intricate path in ordnance piece is fast, accurate and requires only occasional attention from the operator.



DUPLIMATICS are sufficiently powerful for any size work.



Profiling with "one-way" DUPLIMATIC. Molds for plastics.



Standard milling machine milling cavities of aircraft connecting rods.

DETROIT UNIVERSAL DUPLICATOR COMPANY

223 St. Aubin Ave. **Detroit, Michigan**

PORTER-McLEOD 8 INCH COLD METAL SAWING MACHINE

SAVE THOSE VALUABLE MINUTES NEEDED ON WAR WORK . . .

with this TRULY HIGH PRODUCTION MACHINE

Straight, clean, accurate cuts at high speed are assured by this 8" Porter-McLeod Machine which is ideal for general or production work.

Ability to cut stock from 3 inches up, to nest bars or shapes for multiple cutting and a standard 3" per minute feed result in remarkably fast cutting which in turn mean outstanding savings in time. Versatility, too, is assured by the fact that this machine has a capacity for 8" round or 7½" square stock.

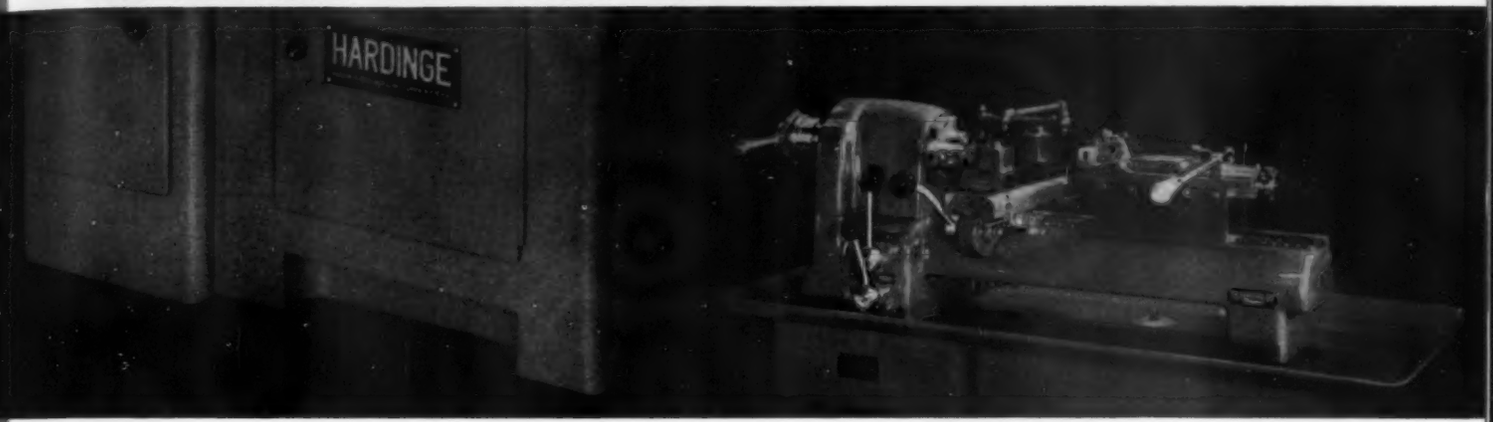
Among the features which contribute to the high productivity of the Porter-McLeod is the unique method employed to pull the blade upward through the stock and the supporting of the blade close to its rim in order to insure against buckling and weaving. Further protection of blade is assured by employing a friction disc feed, an important advantage in production work especially where hard spots may be encountered while cutting at high speed. A further contribution to fast production is the special design of the saws used on this machine which results in cutting action by every tooth.

In the interest of turning out more munitions in less time, investigate the Porter McLeod Cold Metal Sawing Machine TODAY!

Send at once for full details of this truly high production cutting-off machine.

PORTER-McLEOD MACHINE TOOL CO., INC.
Hatfield, Mass., U. S. A.

HARDINGE IS MAKING



NEW PRODUCTION RECORDS FOR

PRECISION SECOND OPERATION WORK

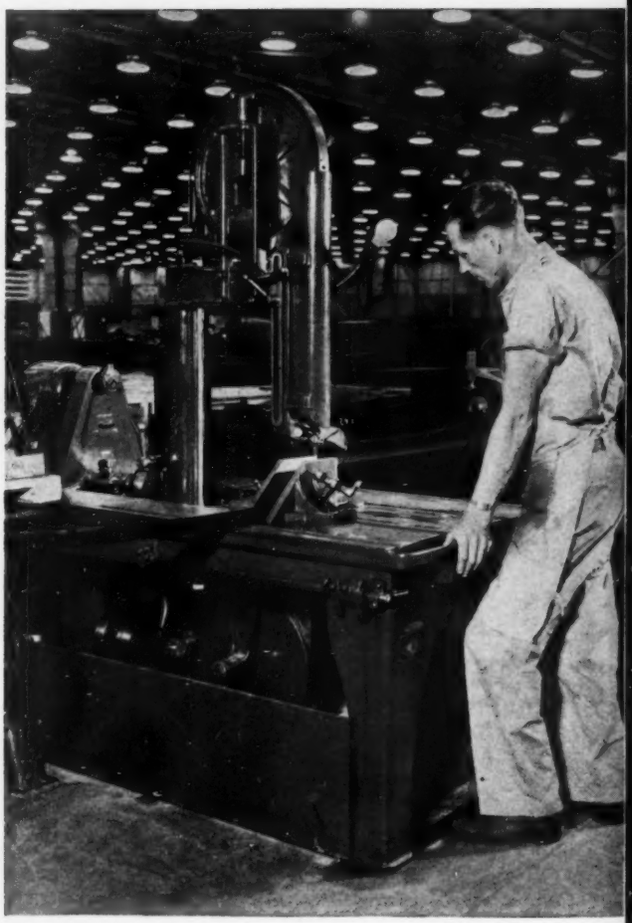
HARDINGE

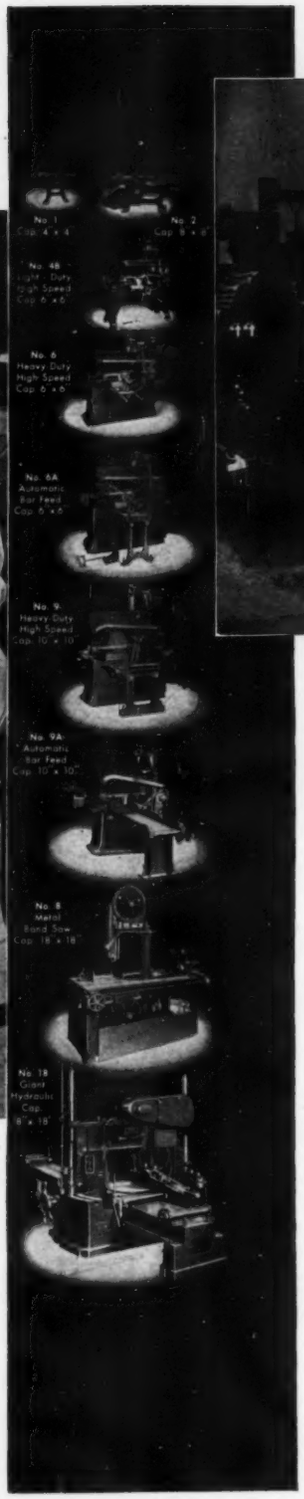
SECOND OPERATION MACHINE

SPECIFICATIONS: 1" collet capacity, 6" step chuck capacity, 5" jaw chuck capacity, 9" swing, 36" bed, lever speed control with spindle brake, 8 speeds forward and 8 speeds reverse from 230 to 3900 R. P. M., six-position tilted turret with automatic indexing and locking head with six independent travel stops, built-in coolant facilities.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"





Cutting standard steel shapes at the Douglas Aircraft Company's new Long Beach plant.

MARVEL Saws were chosen to help the "production of the largest possible number of the finest possible airplanes in the shortest possible time."

In the great new "blackout" Douglas Aircraft Co. plant where even the doors are light trapped and even the brightest moonlight can find no reflection surface—where every piece of equipment is the finest, MARVEL SAWS are found at strategic points, helping to speed the production of the world's most powerful bombers.

MARVEL SAWS

ARMSTRONG-BLUM MANUFACTURING COMPANY
"The Hack Saw People"
5700 BLOOMINGDALE AVE. CHICAGO, U. S. A.
Eastern Sales Office: 225 Lafayette St., New York

FOR SHORT OR LONG RUNS
Boring, Turning, Facing, Grooving, Chamfering
• • • with Precision!
Tomorrow, just as today, the watchword of industry in this country will be "Production." With the lid lifted high on accumulated peace time needs, the advantage will then definitely be with those who today are installing equipment for war production with thought for the future. The Ex-Cell-O Precision Boring Machine—for boring, turning, facing, grooving, chamfering to "tenth" accuracy—is the preferred type and make of equipment among many manufacturers producing parts for war purposes in large quantities today; its extreme flexibility in application makes it an equally sound investment for the inevitable tomorrow, in shops either small or large.
EX-CELL-O CORPORATION • DETROIT
EX-CELL-O MACHINES AND TOOLS
Precision
XLO
EX-CELL-O PRECISION
EX-CELL-O
FOR HIGH PRODUCTION

Black & Decker SPEEDS PRODUCTION, CUTS COSTS, WITH CLEVELAND MODEL "A" Single Spindle AUTOMATICS

BLACK & DECKER

• With *small lots and short runs* constantly involved in their production of portable electric tools, The Black & Decker Manufacturing Company uses Cleveland *Single Spindle* Automatics to good purpose in avoiding "bottle-necks" in their fast-moving production schedule.

Here is evidence of the great adaptability and versatility of these modern machine tools tooled up for small lots ranging from *as few as twenty-five* similar pieces up to 500 pieces in a lot at the Black & Decker plant.

Safety blocks of aluminum are produced from solid bar stock *just twice as fast* as by the previous method of production. Operations include feeding stock to gauge, center, drill and form, trepan, ream and cut-off. *The cost saving is about 50% on this piece.*

Hub discs are produced from S.A.E. stainless steel in lots of 25 to 500 pieces, from 1¼" round bar stock. Operations include feeding stock to gauge, center, form front end and cut-off.

Spindle gears are cut from S.A.E. 3140 round 1½" bar stock, in lots of 25 to 500 pieces, and held to close tolerances on the O.D. thickness and hole. Operations include feeding stock to gauge, center, form and drill, trepan, ream and cut-off.

Feed screw collars are made from S.A.E. 52100 round 1½" bar stock, in lots of 25 to 500 pieces, with close tolerances on the O.D. thickness and on the hole. Operations include feeding stock to gauge, center, drill and form, ream and cut-off.

These are typical of Model A Cleveland *Single Spindle* Automatics' adaptability to the current needs of industry for quick tooling up and change-over from one job to another with the minimum set-up time required. Fitted into production, as "bottle-necks" on hand-screw machines occur, Clevelands quickly produce the parts needed on time . . . *when time is short.*

In 3¾-inch up to 8-inch capacity, Model A is provided with a 4-speed motor drive, universal camming and variable tool feed. In 1 1/16-inch up to 2½-inch sizes constant speed drive is standard, but two-speed drive is optional at slight additional cost. Ask for information on the size of most immediate interest to you.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

2269 ASHLAND ROAD • CLEVELAND, OHIO

Sales Offices: CHICAGO: 565 W. Washington Street • DETROIT: 540 New Center Building
NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland *Single Spindle* Automatics if you make duplicate parts in small quantities. By using *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**

A 5¾-inch Cleveland Model A *single spindle* automatic at Monarch Machine Tool Company, builder of engine lathes.

One of the 1⅜-inch Clevelands used by The Glenn L. Martin Company for *small lot, short run* production.

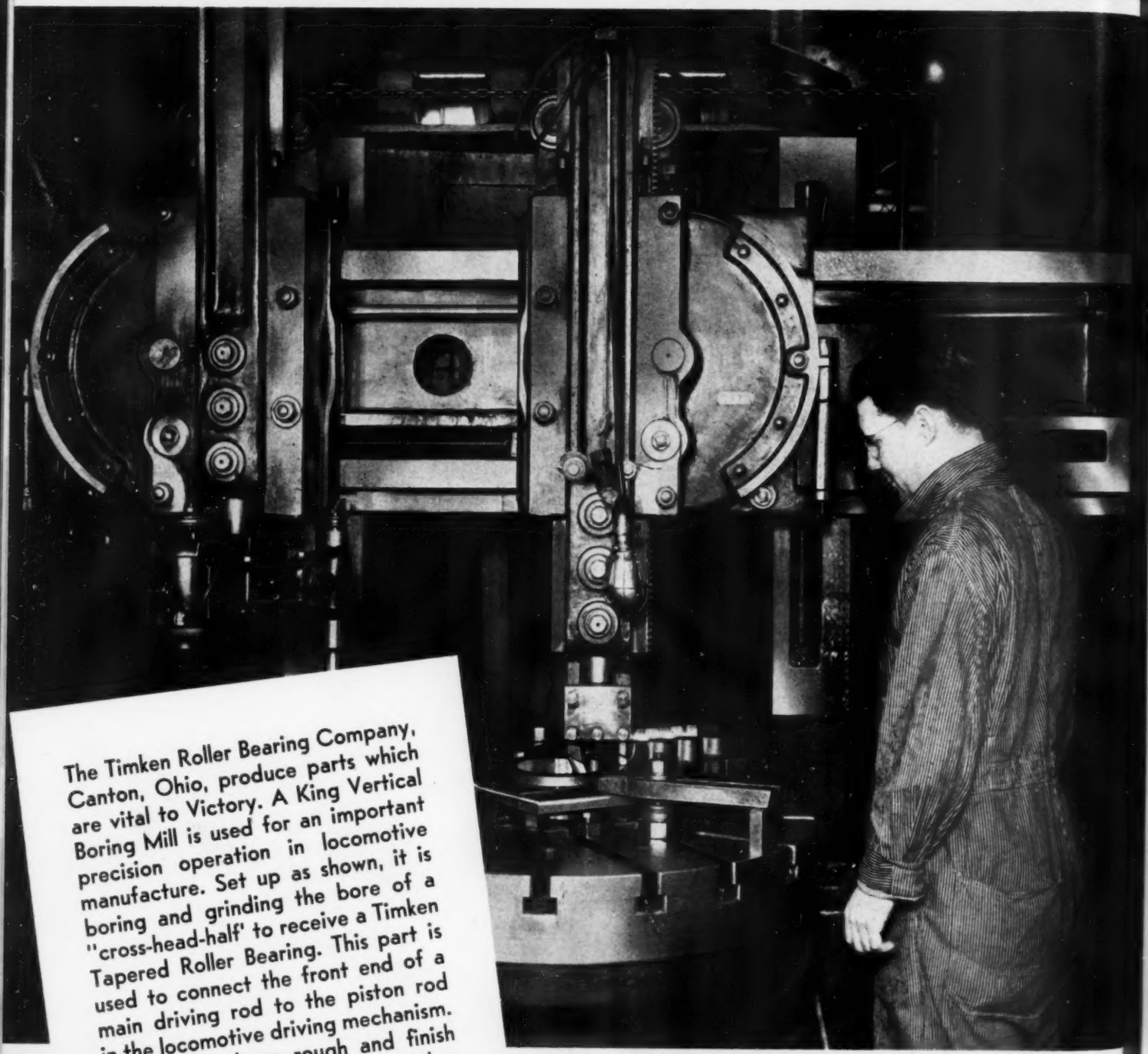
This Model B *single spindle* automatic of 1 1/16-inch capacity is producing spacers from bar stock for Bell Aircraft Corporation.

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL B—Built in 9/16-inch to 2½-inch capacities inclusive

KING



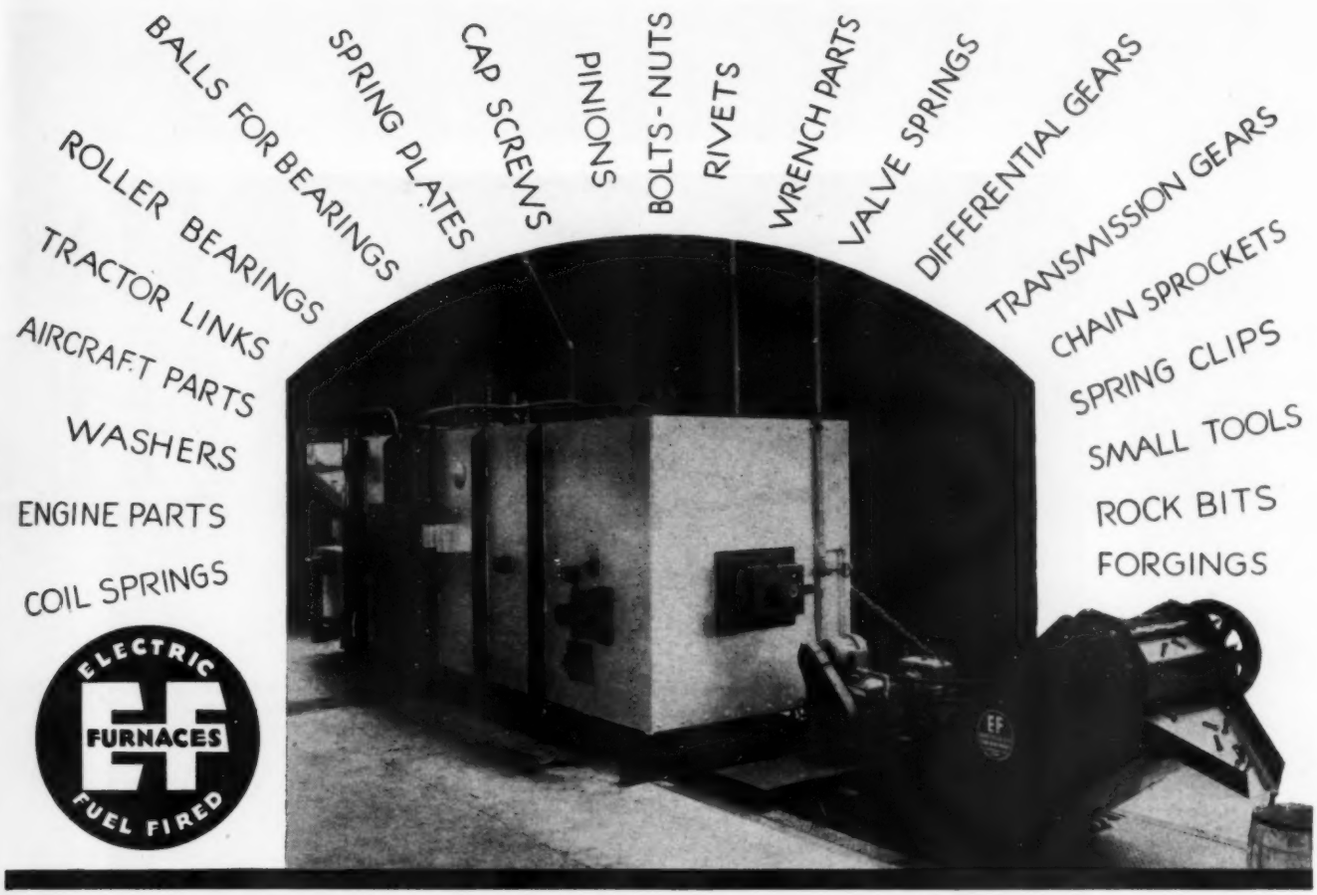
The Timken Roller Bearing Company, Canton, Ohio, produce parts which are vital to Victory. A King Vertical Boring Mill is used for an important precision operation in locomotive manufacture. Set up as shown, it is boring and grinding the bore of a "cross-head-half" to receive a Timken Tapered Roller Bearing. This part is used to connect the front end of a main driving rod to the piston rod in the locomotive driving mechanism. After it has been rough and finish machined, it is mounted on another fixture and ground with the attachment shown on the left-hand tool ram.. Bore diameter is held to within .001 inch.

Designed and Constructed by

THE KING MACHINE TOOL COMPANY

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO



For Heat Treating Machine Gun Cartridge Clips and Miscellaneous Other Parts and Products

- - - 300 to 1700 lbs. per Hour

- - - Uniformly - - - Automatically - - - Continuously

E F Continuous Chain Belt Conveyor Type Furnaces are handling all kinds of products, ranging in sizes from small springs and machine gun cartridge clips up to large crawler links for tanks and tractors. Hundreds of these furnaces are in operation, handling such products as listed above.

The material is loaded directly onto rugged heat resisting cast link belt conveyors. Without further attention, it is carried through the furnace, uniformly heated to the proper temperature and automatically discharged through a sealed chute to the quenching medium or directly from the furnace as desired. The chain belt conveyor returns within the furnace without cooling—no pans or trays are used in the furnace—100% net material.

These furnaces are built for oil, gas or electric heat in five standard sizes with capacities ranging from 300 to 1700 lbs. per hour. Larger or smaller sizes can also be furnished. They are also designed for using special protective atmospheres for scale-free heat treating and hardening without decarburization.

The hundreds of installations in operation, handling all kinds of material, have proven them the most satisfactory and dependable general purpose heat treating machines built for the uniform, economical, production heat treatment of miscellaneous small and medium sized parts and products.

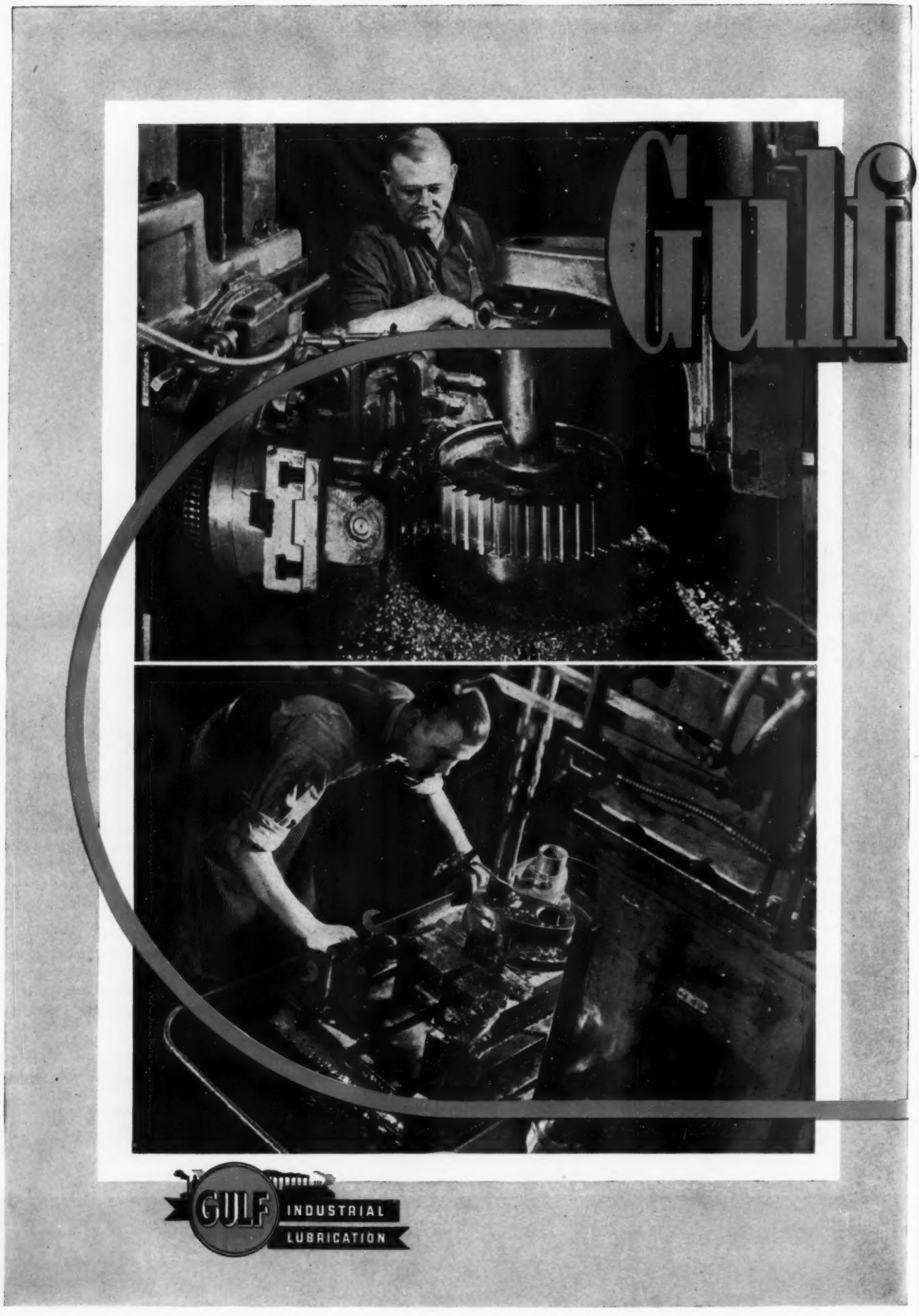
We will be glad to give you complete information, including installation and operating costs if interested.

The Chain Belt Conveyor Furnace is only one of the numerous types we build for various heat treating purposes. Other outstanding EF production furnace installations include equipment for the production heat treatment of tank armor castings, cartridge cases, shell forgings, bomb and gun parts, aircraft and aircraft engine parts, aluminum and magnesium castings, and many other allied products. We specialize in designing and building production furnaces.

Send for circular showing these and other types

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production


Gulf
GULF
INDUSTRIAL
LUBRICATION

Cutting Oils

are helping make new production records in many plants

Gulf Cutting Oils make possible higher cutting speeds or improved finish, or both — increased number of parts per tool grind, and longer tool life.

OUTSTANDING results with improved Gulf Cutting Oils are *usual* results! Here's a typical performance record of Gulf Cut-Aid, for example, in a prominent metal working plant in the East.

Operation—forming aluminum, on a Brown and Sharpe automatic, reducing ¾" round stock to ¼".

Tool life improvement—from 3 hours between regrinds to 11 hours.

Finish improvement — from "fair" to "almost unbelievable."

Combining the best possible lubrication and effective cooling in the cutting and tool-chip contact areas, Gulf Cutting Oils are contributing to faster and more accurate machining, longer tool life, and improved finishes in scores of plants. Production increases in many cases are truly remarkable!

Just off the press is a new booklet on Gulf Cutting Oils, which includes 24 pages of useful data on machining the modern metals: nickel steels, high speed steels, stainless steels, the wrought bronzes, and aluminum—plus facts on the cemented carbides, and hints on tool supports, tool holders and tool grinding. Write for your copy of this helpful and interesting booklet today.

Send for your copy *today*

Gulf Oil Corporation · Gulf Refining Company AM
3800 Gulf Building, Pittsburgh, Pa.

Please send me, without obligation, a copy of the new booklet, "Gulf Cutting Oils", which includes a 24-page Machining Guide.

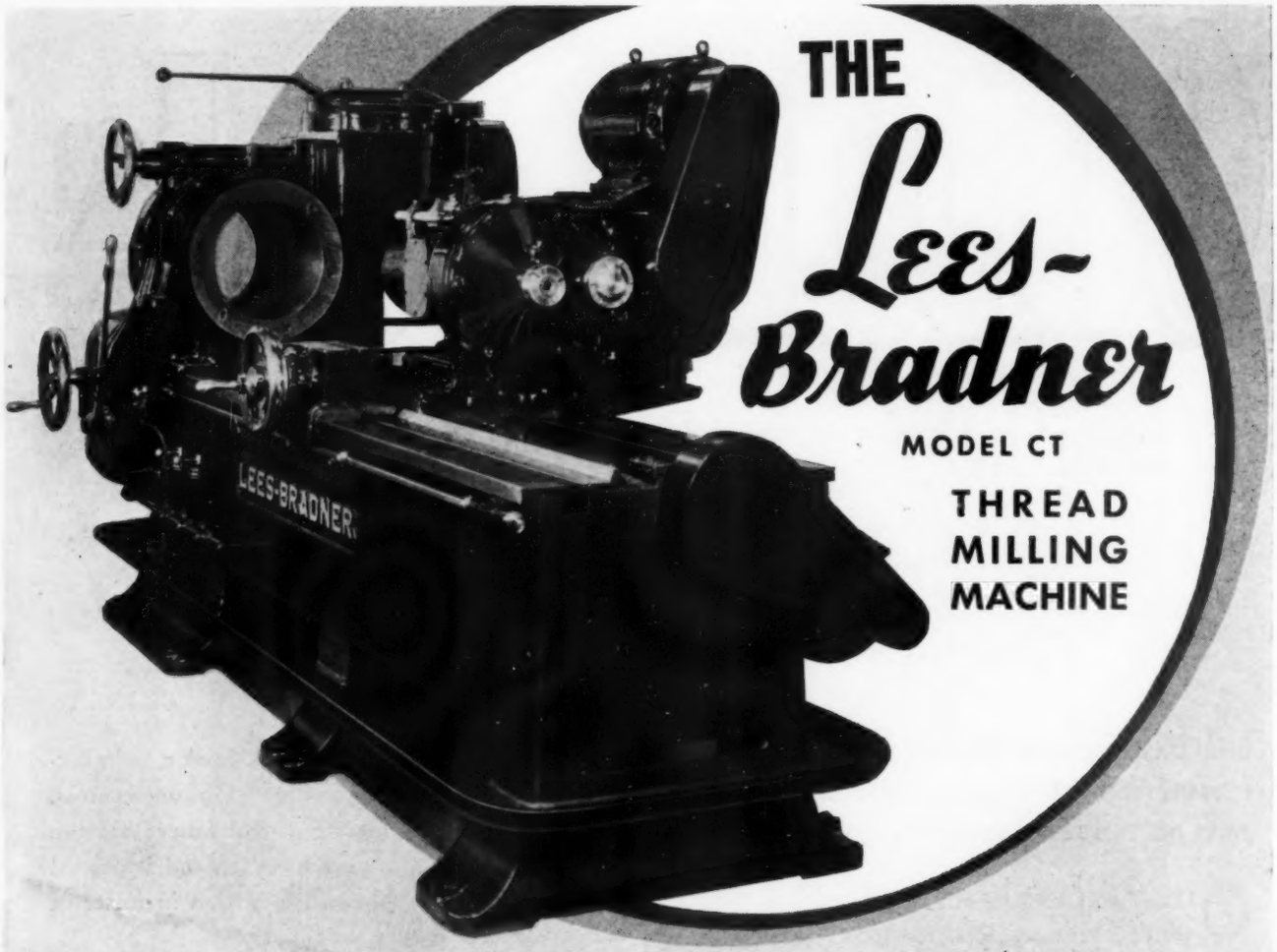
Name_____

Company_____

Address_____

HERE'S PRECISION THREAD MILLING

FOR PRODUCTION WORK



THE *Lees-Bradner*

MODEL CT

THREAD MILLING MACHINE

The Lees-Bradner Model CT Machine is suitable for the generation of threads using either a single cutter or a ring (hob) type cutter, since the cutter head is actuated by a precision lead screw, thereby enabling users to take advantage, not only of the benefits of hob type thread milling, but also when the occasion demands it, to use the same machine for single cutter work.

The Model CT machine is particularly suitable for the larger, more complex parts requiring the ultimate in precision threads, items such as oleo struts, breech rings, propeller blades, and other similar larger components.

LEES-BRADNER BUILDS A COMPLETE LINE OF THREAD MILLING MACHINES.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.

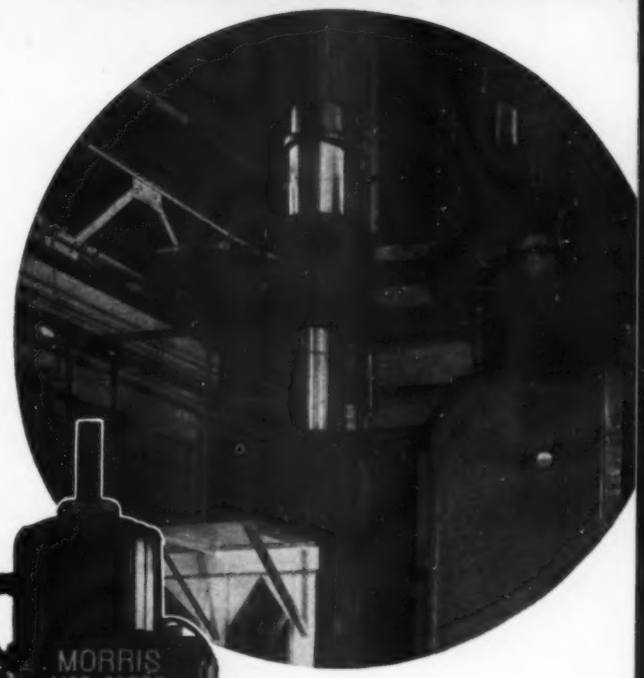
MORRIS MOR-SPEED *Radial*

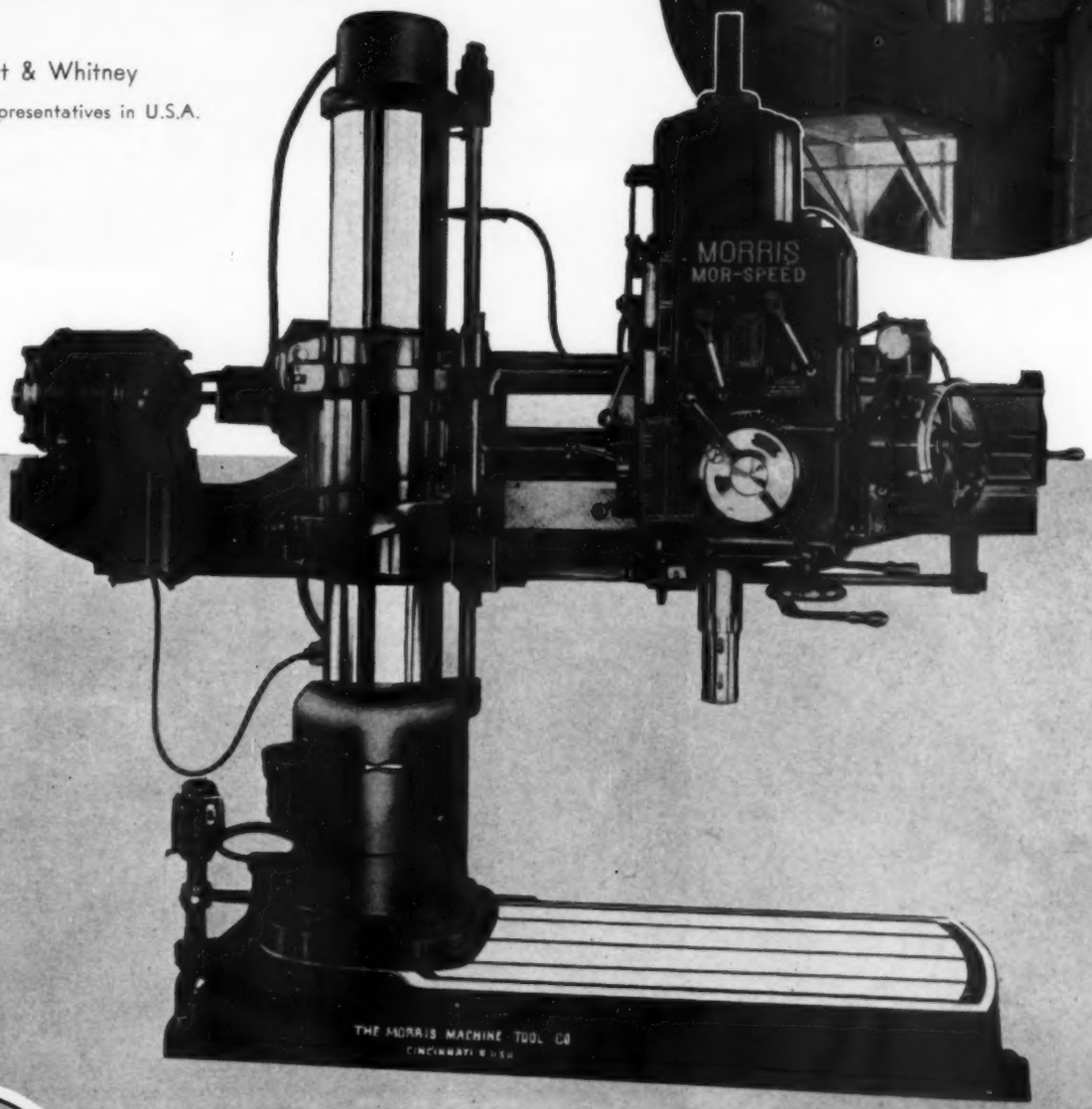
brings speed and versatility to war production jobs

This is typical of the many varied applications of Morris Radials to all out war production. This unique installation shows a Morris Radial performing drilling, tapping, boring and facing operations from a single set-up and resulted in a saving of 50% handling—25% machining time.

No matter what your operations are, you will find Morris Mor-Speed Balanced Arm and Head Design—Centralized Control—Smoother Power—Ample Speeds and Feeds will help you to speed up production and cut costs on radial work. Write for Bulletin.

Pratt & Whitney
exclusive representatives in U.S.A.





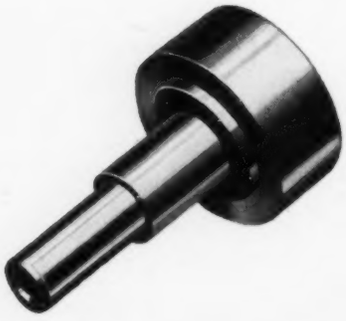
Builders of MOR-SPEED *Radials*

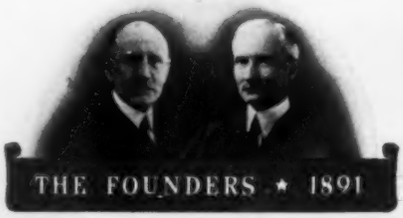
The MORRIS *Machine Tool Co.*

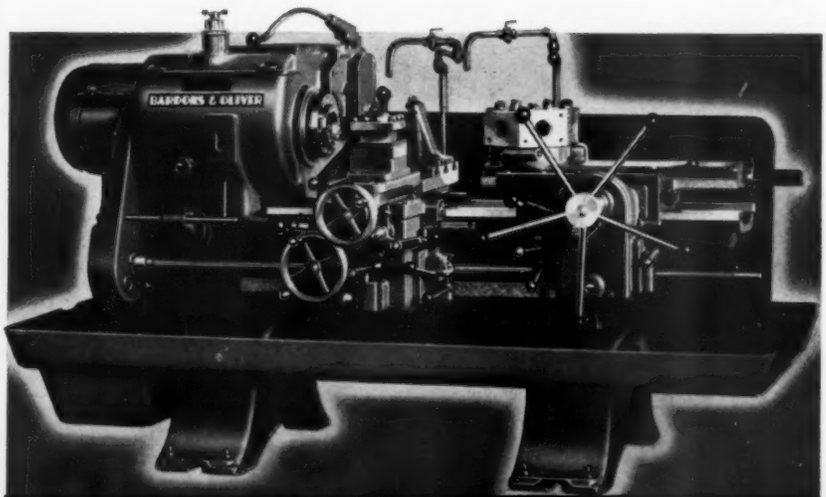
CINCINNATI, OHIO

WHEN YOU BUY A TURRET LATHE

POWER TO SPARE – to handle today's carbide jobs.
ADEQUATE RANGE OF SPEEDS – because efficient production depends on the use of correct cutting speeds.
GREAT RIGIDITY – to permit heavy cuts at high speeds.
EASY OPERATION – to conserve your operator's energy.
HIGH DEGREE OF ACCURACY – to produce a high quality product.
LOW MAINTENANCE – to keep your production rolling steady and your cost low.
All of these worthwhile advantages will be yours with a Bardons & Oliver Turret Lathe.



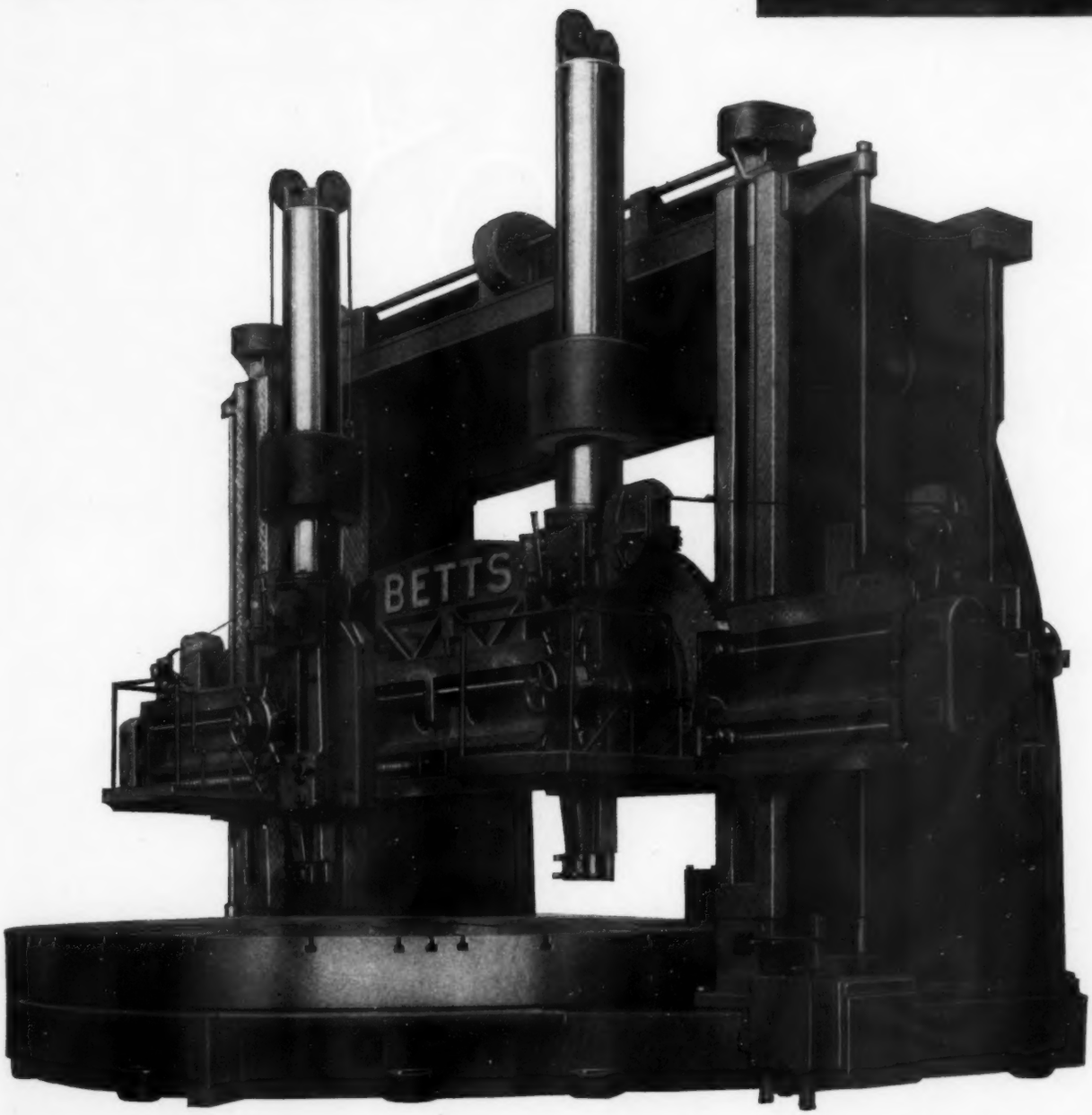




BARDONS & OLIVER, INC.
1133 W. 9TH ST. . . CLEVELAND, OHIO

BETTS

BORING MILLS IN THE VICTORY PROGRAM ARE PRODUCING RESULTS

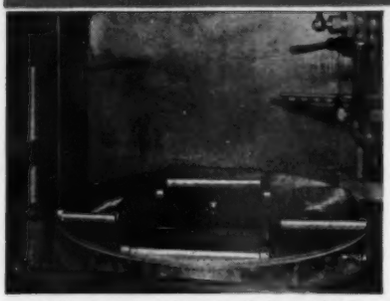


BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

STANDARD
Dial Bore Gages
"CONVOY
YOUR PARTS
THRU
PRODUCTION"
STANDARD GAGE CO., INC.
POUGHKEEPSIE, NEW YORK

"PUT IT ON THE BLANCHARD"

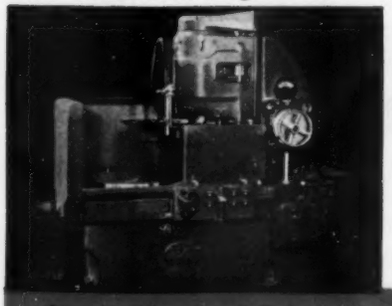


Sides ground parallel within .00015"

One end ground square with side within .0001"

Other end ground square within .0001" parallel within .00015"

End plate, roll, and blades — all Blanchard ground



No. 18 Blanchard Grinder

SQUARE

WITHIN .0001"

Two Blanchard No. 18 Surface Grinders, with Blanchard fixtures produce these refrigerator compressor blades to extremely close limits for accuracy and finish — at a rate of 1000 complete blades (ground 6 sides) every 8 hours.

360 blades are held on the chuck at one time while one side is being ground, then they are turned over and the other side is ground parallel within .00015". The ends and edges of the blades are then ground in six 10-station fixtures mounted on the chuck.

A Blanchard Demagnetizer is used between each operation on both the work and fixtures.

BLANCHARD

MACHINE COMPANY

64 STATE ST., CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production

★ Adaptability

Fixture Saving

Operation Saving

Material Saving

★ Fine Finish

★ Flatness

★ Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

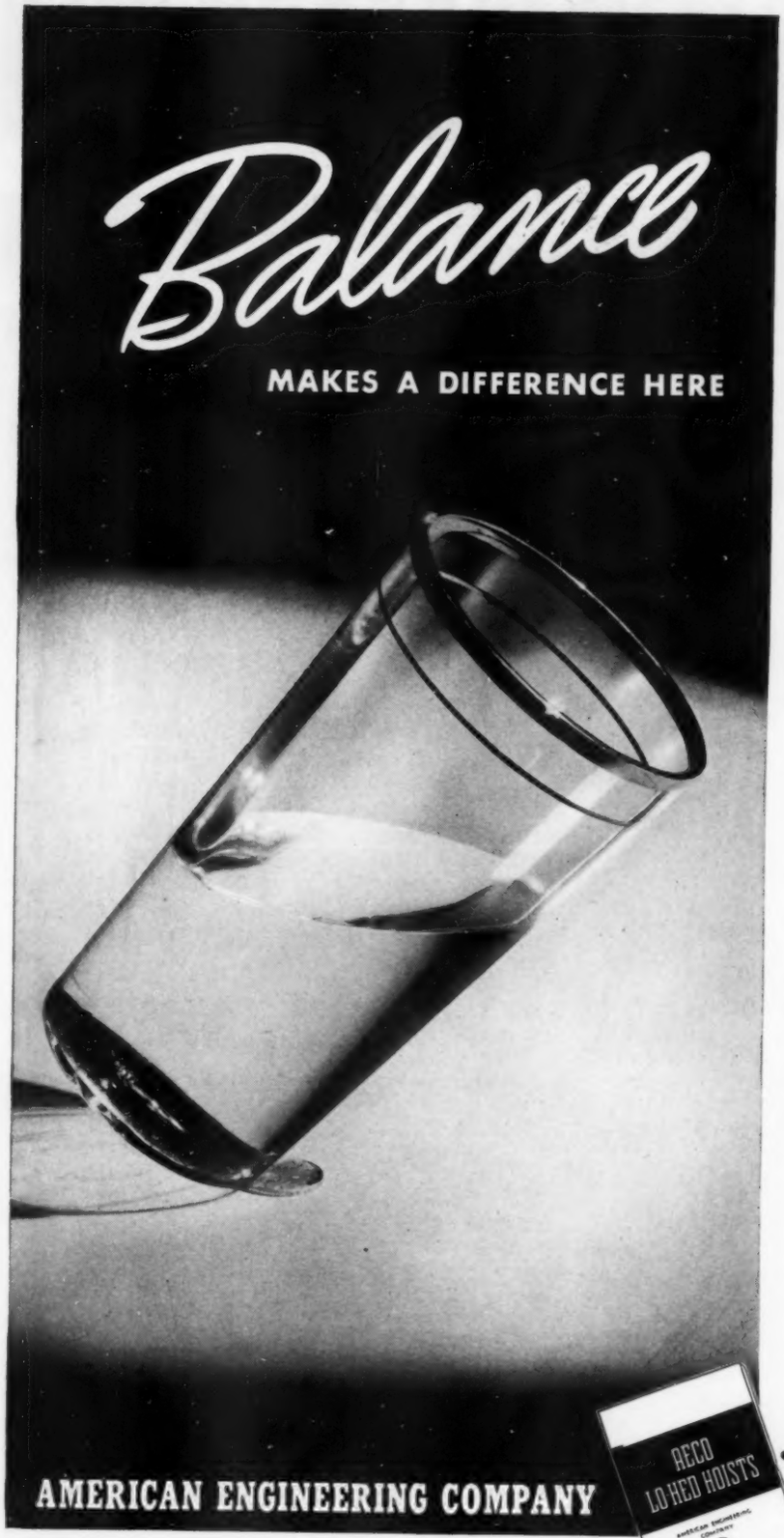
Cleveland Knuckle Joint Presses, which are built in a wide range of sizes and in capacities from 150 tons to 1200 tons, exert a comparatively short but extremely powerful squeeze on the metal and for this reason they are used largely for embossing, coining, sizing and heavy stamping.

The 10 K exerts a pressure of 1000 tons, has a bed area of 37" x 31", a 5" stroke, ½" adjustment and operates at 30 R.P.M.

The 4 K exerts a pressure of 400 tons and is equipped with an electrically controlled, air operated friction clutch and brake. It has 11" stroke, bed area of 31"x30" and operates at 20 R.P.M.

The two Presses illustrated are merely typical of Cleveland Knuckle Joint Presses which, because of their rugged construction, accuracy and long life, are serving the Metal Working Industry with maximum efficiency.

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY
CLEVELAND, OHIO

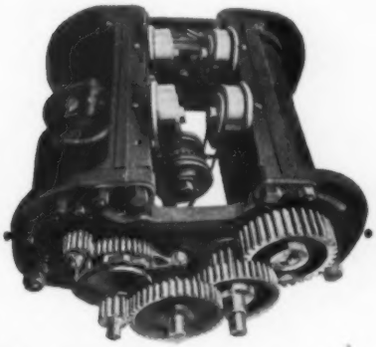


BALANCE makes a difference in electric hoists

It is a fact that balance makes a startling difference in electric hoist design.

The Lo-Hed hoist is unusual in that its motor and drum are balanced around the beam. Take a look with us and you'll see what this does. It means that the hook can be pulled up close to the beam—a desirable plus feature for which you pay no premium. It means that since motor and drum are parallel they can be connected through a train of efficient spur gears. The drum, motor and gearing are housed by easily removable covers.

Lo-Hed hoists have many other service and safety features, shown in the 28-page Lo-Hed catalog. No point of manufacture is more vital to you today than the precision with which Lo-Heds are built. Although production has been stepped up, Lo-Heds are as painstakingly made now as they were before the war. On past experience that means good service from a Lo-Hed years after we win. So get a Lo-Hed. Send for that illustrated catalog we mentioned today.



The Lo-Hed Hoist Is Applicable To Any Monorail System
There's A Balanced Lo-Hed Electric Hoist For Every Purpose

•

Look in your Classified Telephone Directory under "A-E-CO LO-HED HOISTS" for your nearest representative

OTHER A-E-CO PRODUCTS: **TAYLOR STOKERS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER**

AMERICAN ENGINEERING COMPANY
2407 Aramingo Avenue, Philadelphia, Penna.

☐ Please send me your complete catalog of LO-HED HOISTS
☐ Ask your representative to get in touch with me promptly

Name _____

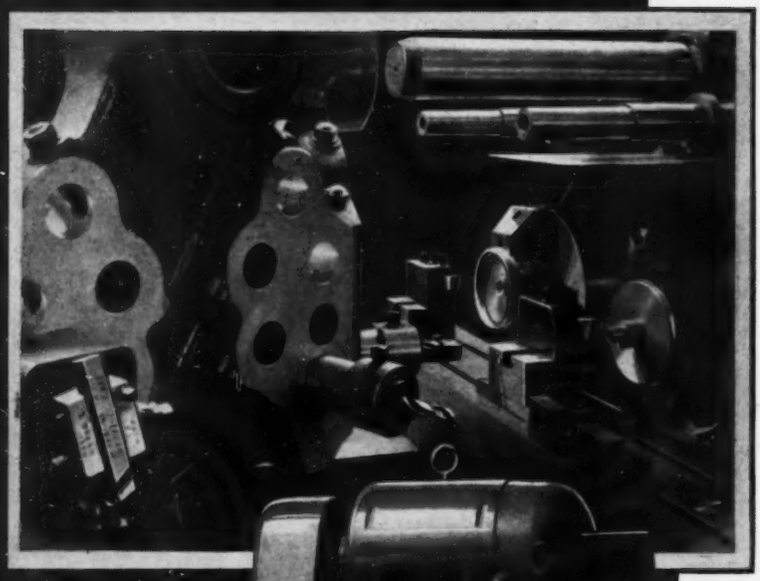
Company _____

Street Address _____

City _____ State _____
(Please Print Plainly)

P&J BLUEPRINTS

HIGH PERFECTION IN MACHINING GEAR BLANKS ON P & J TWO-SPINDLE AUTOMATIC

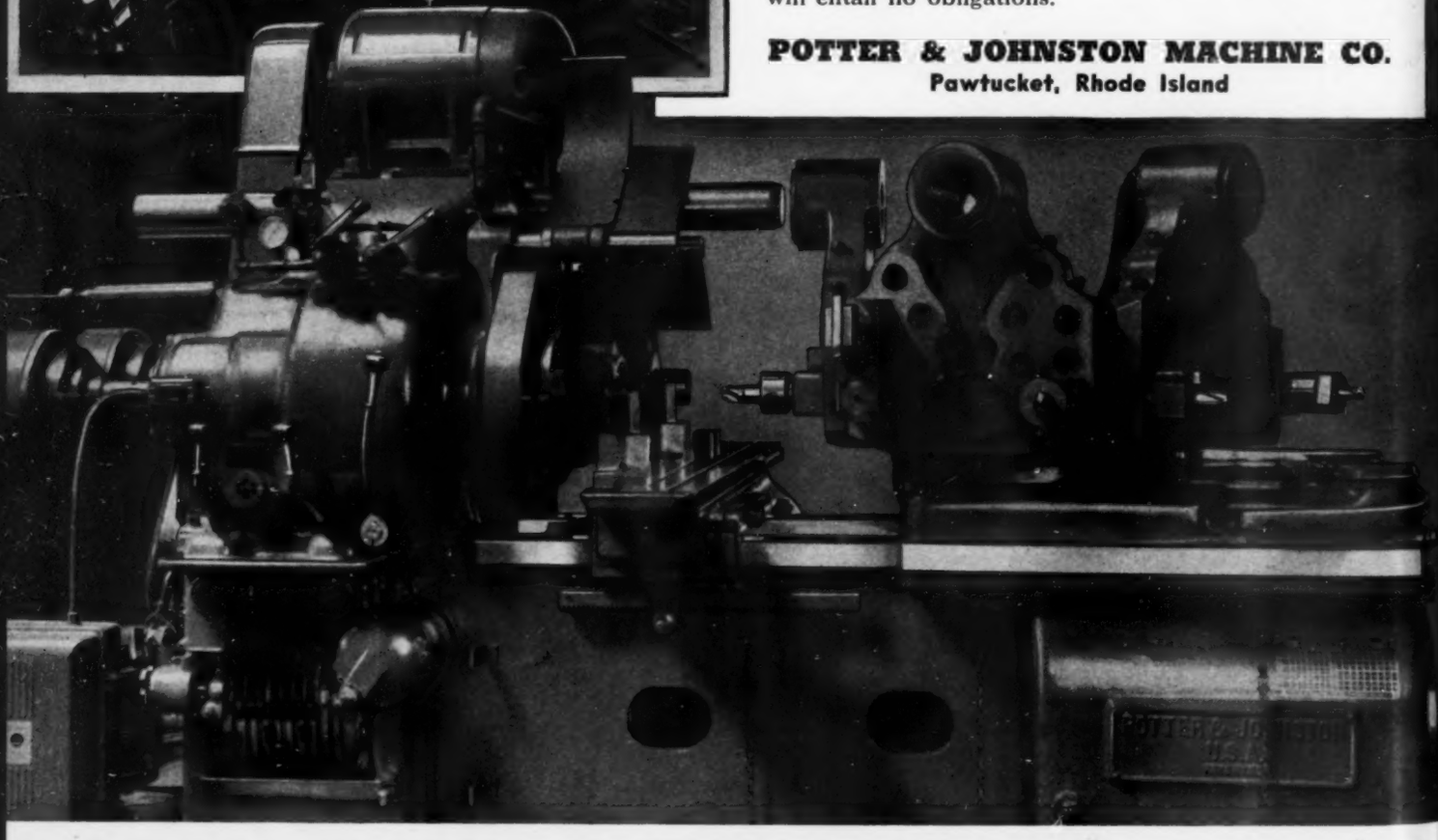


The P & J 5-D-2 (two spindle) 12″ Automatic has demonstrated its efficiency and economy in operation. The savings are emphasized when comparing this machine with a single spindle unit, particularly from the viewpoint of output and initial investment.

The set-up possible with the 5-D-2 Automatic enables either two identical operations to be performed simultaneously, or two different operations to be performed so that the job can be completely machined in one cycle of the turret.

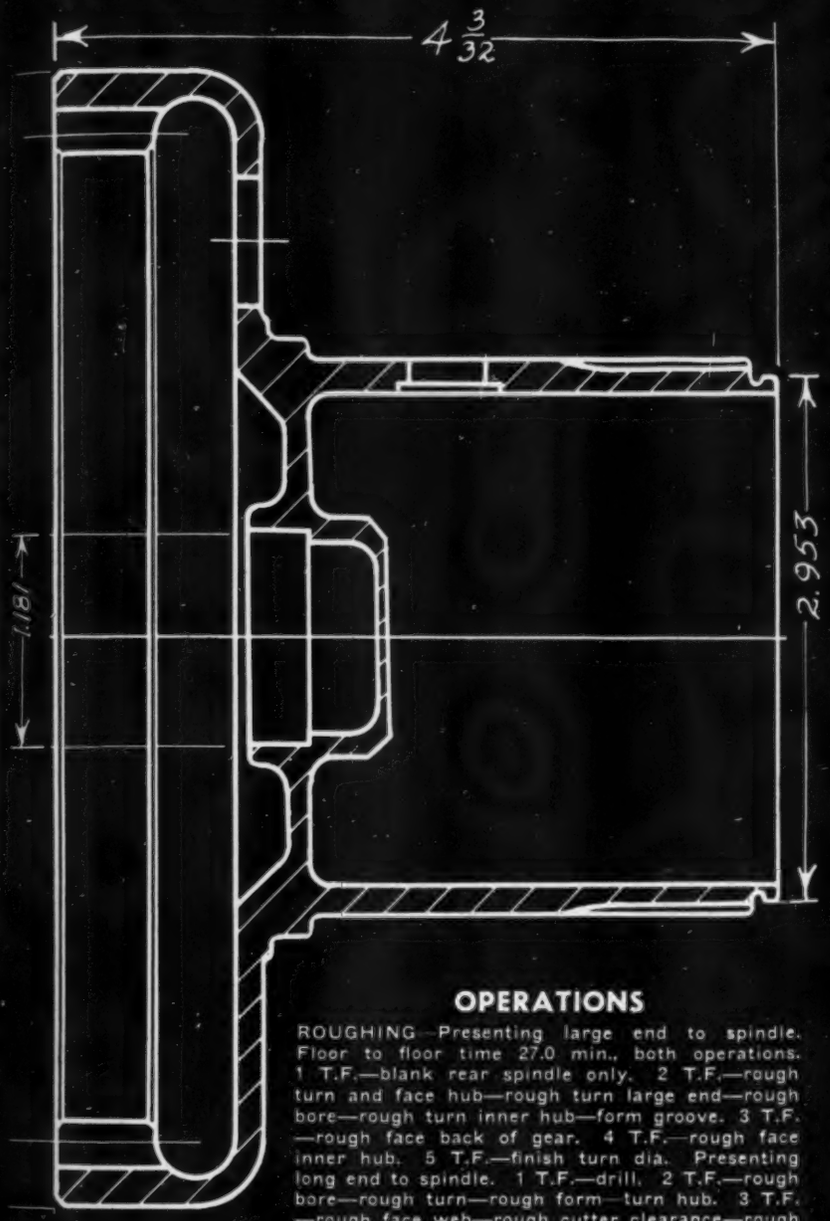
The gear blanks (illustrated) furnish a typical example of the efficiency of this machine. Production is very high—an exceptional degree of accuracy is obtained—an unusually fine finish is produced. Savings are further indicated by the fact that four machines are handled by one operator, and one toolsetter. Similar efficiencies and economies can be applied to your work; an application to P & J engineers for recommendations will meet with a quick response and will entail no obligations.

POTTER & JOHNSTON MACHINE CO.
Pawtucket, Rhode Island



POTTER & JOHNSTON

S OF PRODUCTION



OPERATIONS

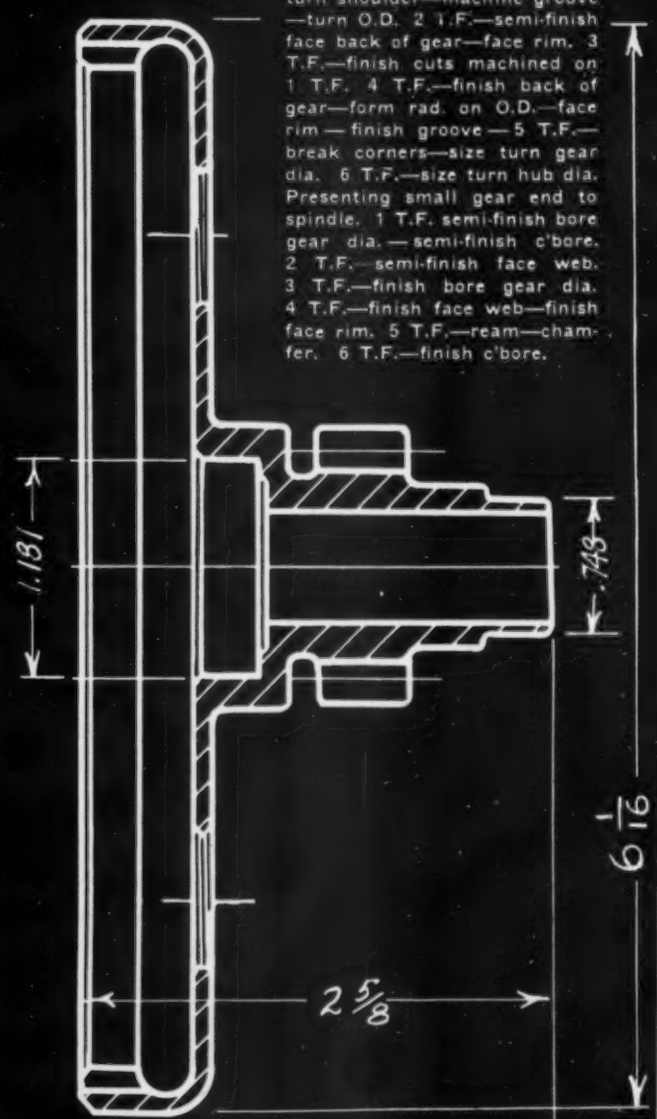
ROUGHING—Presenting large end to spindle. Floor to floor time 27.0 min., both operations. 1 T.F.—blank rear spindle only. 2 T.F.—rough turn and face hub—rough turn large end—rough bore—rough turn inner hub—form groove. 3 T.F.—rough face back of gear. 4 T.F.—rough face inner hub. 5 T.F.—finish turn dia. Presenting long end to spindle. 1 T.F.—drill. 2 T.F.—rough bore—rough turn—rough form—turn hub. 3 T.F.—rough face web—rough cutter clearance—rough face rim. 4 T.F.—rough face—square bottom of hole. 5 T.F.—blank on front spindle.

FINISHING—Part hardened to 310 Brinell. Presenting long end to spindle. Floor to floor time 50.0 min., both operations. 1 T.F.—semi-finish bore—face. 2 T.F.—semi-finish bore gear dia.—semi-finish turn O.D.—semi-finish form—face—turn. 3 T.F.—finish face web—form cutter clearance—face rim—face back of gear—form rad. 4 T.F.—finish bore—bore hub—break corners—finish turn gear end. Presenting large end to spindle. 1 T.F.—finish face hub—form rad. 2 T.F.—semi-finish hub—semi-finish shoulder—semi-finish bore—semi-finish inner hub—form groove. 3 T.F.—face shoulder—machine groove in hub. 4 T.F.—finish hub—finish shoulder—break corners.

OPERATIONS

ROUGHING—Presenting open end to spindle. Floor to floor time 19.5 min., both operations. 1 T.F.—spot drill. 2 T.F.—drill hole half way—rough turn—rough face. 3 T.F.—rough turn O.D.—rough turn O.D. small gear—rough face. 4 T.F.—rough face back side small gear. 5 T.F.—semi-finish turn small gear. 6 T.F.—finish turn small gear. Presenting small gear end to spindle. 1 T.F.—spot drill. 2 T.F.—drill hole half way—rough turn—rough face. 3 T.F.—rough turn O.D.—rough turn small gear—rough face. 4 T.F.—rough face back of gear. 5 T.F.—semi-finish turn small gear. 6 T.F.—finish turn small gear.

FINISHING—Part hardened to 310 Brinell. Presenting open end to spindle. Floor to floor time 47.5 min., both operations. 1 T.F.—finish turn small gear—semi-finish turn shoulder—machine groove—turn O.D. 2 T.F.—semi-finish face back of gear—face rim. 3 T.F.—finish cuts machined on 1 T.F. 4 T.F.—finish back of gear—form rad. on O.D.—face rim—finish groove—5 T.F.—break corners—size turn gear dia. 6 T.F.—size turn hub dia. Presenting small gear end to spindle. 1 T.F. semi-finish bore gear dia.—semi-finish c'bore. 2 T.F. semi-finish face web. 3 T.F.—finish bore gear dia. 4 T.F.—finish face web—finish face rim. 5 T.F.—ream—chamfer. 6 T.F.—finish c'bore.



AUTOMATICS

a four-point service plan to help

1 **Renewal Parts Warehouses**
17 warehouses conveniently located throughout the country now carry an adequate stock of frequently used renewal parts.

2 **District Repair Service**
33 manufacturing and repair plants are strategically located to speed repair service.

3 **District Engineering Service**
Experienced engineers in every industrial district are available to help solve production problems.

4 **Free Help for Maintenance Men**
Valuable information on how to keep electrical equipment on the job.

The nerve center of your production line is your electrical equipment. Electrical failure anywhere may result in serious production loss. To help you get more from your electrical equipment—to keep it on the job longer—Westinghouse is prepared to help you in these four ways:

First Westinghouse has established 17 warehouses where you can obtain renewal parts quickly. Stocks on hand include those parts normally subjected to wear or burning such as contact tips, shunts, arc chutes, operating coils, armature and field coils, bearings, etc. Be sure your own stock of renewal parts is adequate to meet emergencies. When it runs low order direct from our local office.

Second Westinghouse has arranged to facilitate major repair work. In addition to the 17 parts warehouses, Westinghouse has established 33 district manufacturing and repair plants. Each of these plants is equipped to repair, remodel or recondition electrical apparatus. This includes rewinding motors, generators, and transformers; replacing or building up worn parts such as bearings, commutators and current collectors; reblade and reline turbines, or remodel them for other operations.

More than 4,000 employes are now serving our customers from these 33 Westinghouse district plants alone. To save time on repair service, call our local office.

Third Experienced engineers are available at every Westinghouse office to help you with your electrical and production problems. These men are constantly working with plant engineers in all types of industries. Problems that occur once in the lifetime of a manufacturer are often daily occurrences with our engineers. Thus, problems solved in one plant provide a quick answer to similar problems elsewhere. Maybe these men can help you, too.

Fourth One of the most important single group of workers in your plant is your maintenance crew. These men deserve all the help you can give them.

Westinghouse has prepared a valuable book on the care and maintenance of electrical equipment. Pocket-size, it gives helpful hints on the care of linestarters, bearing lubrication and maintenance, tips on general inspection and many other suggestions on how to keep electrical equipment on the job.

"Maintenance Hints" is free. Each of your maintenance men should have a copy. To be sure they get one, fill in the coupon now and mail it today.

All of the above services are available through our local office. A phone call will bring you any one or all of them.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

WESTINGHOUSE

Westinghouse

keep your machines running

FREE

HINTS ON HOW TO MAINTAIN ELECTRICAL EQUIPMENT

Continuous production depends on proper maintenance. This book will help. Thousands of maintenance men are already using it. Gives timely tips on the care and maintenance of electrical equipment. Published in two volumes. You can have both. Vol. I is wire-bound. Vol. II is loose-leaf so additional booklets can be added as released.

Fill in this coupon now and mail it today. When we receive your request your name will automatically be placed on our mailing list to receive Westinghouse Maintenance News—another free publication for maintenance men, issued periodically to give latest news on maintenance methods.

J-94490

When you request copies of Maintenance Hints, your name will automatically be placed on our mailing list to receive Maintenance News.

ME SAVER FOR AMERICAN INDUSTRY

Westinghouse Elec. & Mfg. Co.,
East Pittsburgh, Pa., Dept. 7-N

Maintenance Sales Dept.:

Please forward copies of Maintenance Hints, Vol. I and Vol. II, and place my name on your mailing list to receive both the regular Maintenance Hints bulletins and Maintenance News.

Name_____

Title_____

Company_____

Address_____

City_____ State_____

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws—End Mills— Taps—Dies—Screw Plates —Profile Cutters—

THE TOOLS YOU BUY AGAIN

Try them on the basis of ASSURED *better performance . . .*

Shop after shop has come to recognize the ruggedness, accuracy and fast cutting action of UNION TOOLS after proving them out on difficult jobs.

There is sound reason for the better performance of these cost cutting tools. One of these reasons is the *experience behind them*—an experience that involves years of research, as well as outstanding technical, metallurgical and manufacturing facilities second to none in the field of small tool production.

Because Union has the means for producing tools of the finest quality and concentrates every resource on achieving highest performance standards on all tools bearing the name "UNION", users of UNION tools can always be certain of efficient, economical service.

UNION TWIST DRILL CO.
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec
Representatives throughout the world

UNION

MULT-AU-MATICS WERE *READY!*

BULLARD

ONLY MULT-AU-MATICS HAVE ALL THESE FEATURES COMBINED

1. Eight stations
2. Independent speeds and feeds at each station
3. Horizontal Chucks
4. Minimum floor space
5. Automatic operation
6. Easy changeover
7. Continuous flow lubrication
8. Interlocking safety devices
9. Easy Tooling

When the call came to change over from peacetime to wartime production, Mult-Au-Matics were *ready*. They were ready because they are Standard machines. The only things about them that are "special" are the fixtures and tooling for the job in hand — plus of course the very special inbuilt speed, accuracy and reliability that come from years of experience in machine tool building.

Bullard is everlastingly proud that the Automotive Industry is finding Mult-Au-Matics just as valuable in 1942 as they were in 1940 — which is a pretty good sign they will still be just as valuable when the pleasure car assembly lines start up again!

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

SIDNEY LATHES

BRING MODERN DESIGN TO WAR RUSHED INDUSTRY

A typical example of the modern design features in Sidney Lathes is the

CARRIAGE AND COMPOUND REST

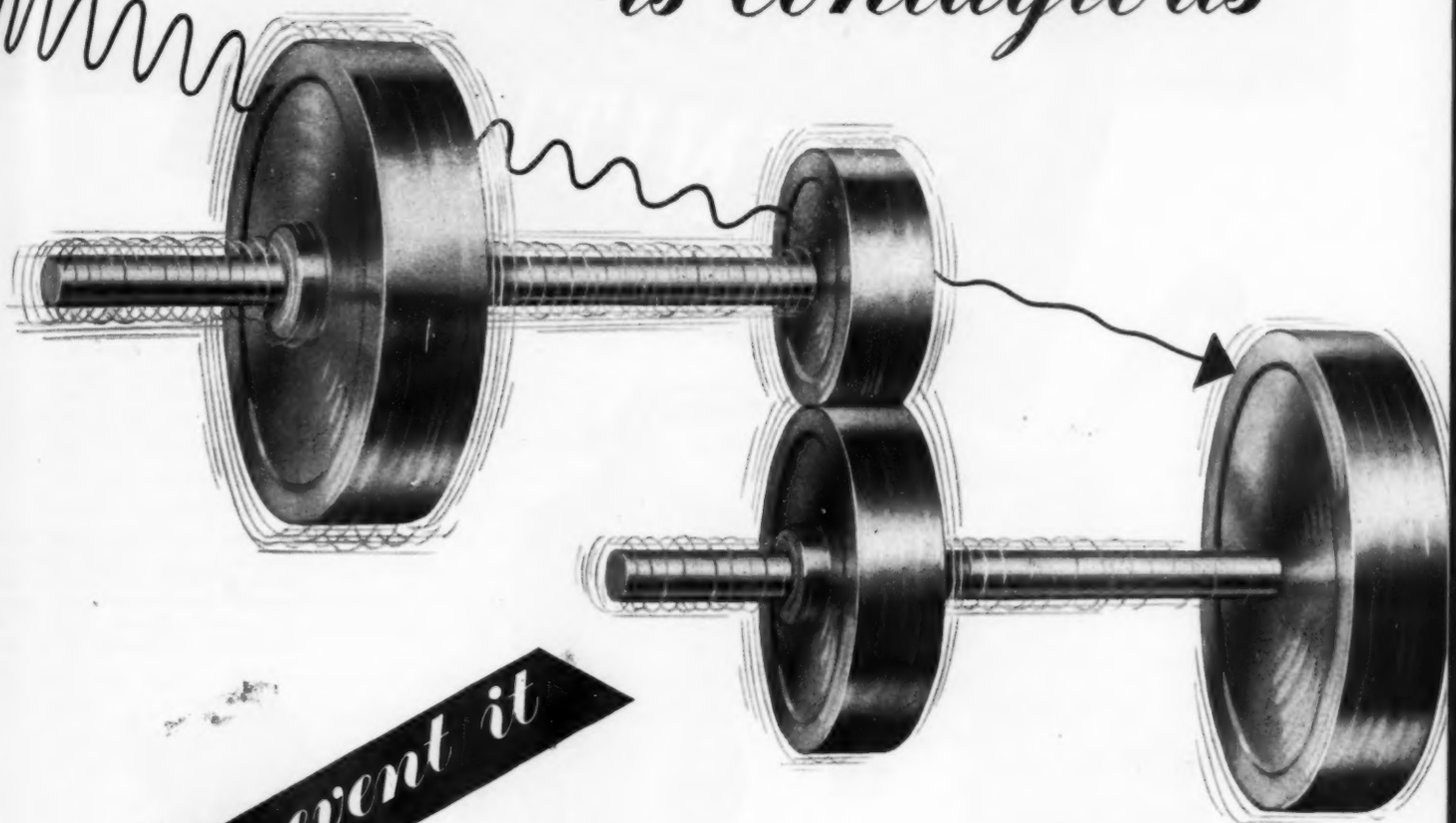
Neoprene wipers, unaffected by oil, wipe all chips and dirt from the ways, preventing scoring, excessive wear and maintain original accuracy for years to come. The cross feed and compound screws are furnished with COMPENSATING nuts. Tapered accurately fitted gibs, properly placed, are provided to take up for wear. A micrometer stop on the cross feed provides an adjustable depth stop for turning or for internal and external thread chasing.

For further details on this or other models fully descriptive bulletins are available.

The SIDNEY MACHINE TOOL Company

SIDNEY U.S.A. OHIO

VIBRATION *is contagious*



prevent it

● Vibration is "catching"! When found in any machine assembly, it travels from one part to another, spreading trouble—causing excessive wear, reducing efficiency, shortening the life of the whole machine.

Most susceptible—and the usual sources of vibration—are these high-speed rotating parts. Here the slightest amount of unbalance multiplies itself by the square of R.P.M.

Correcting static and dynamic unbalance is now a quick and easy matter with the new Gisholt Dynetric Balancing Machines. Using the radio principle of amplification, they enable you to locate and measure unbalance vibrations as small as .000025". The accurate diagnosis takes but a few seconds; the preventive measures a few more. The result is quieter operation and longer life in a better product. Write for literature. Gisholt Machine Company, 1201 East Washington Ave., Madison, Wisconsin.

● *Gisholt Dynetric Balancing Machines are serving in many vital war industries in balancing such high-speed rotating parts as armatures, turbine rotors, crankshafts, super-charger impellers, and many others.*

Look ahead—Keep ahead—With Gisholt improvement

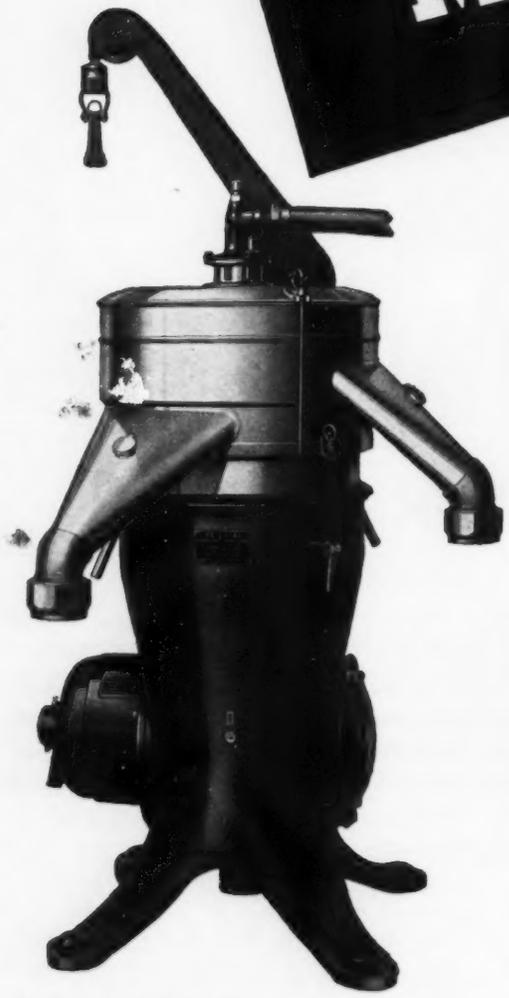
GISHOLT

DYNETRIC BALANCING MACHINES

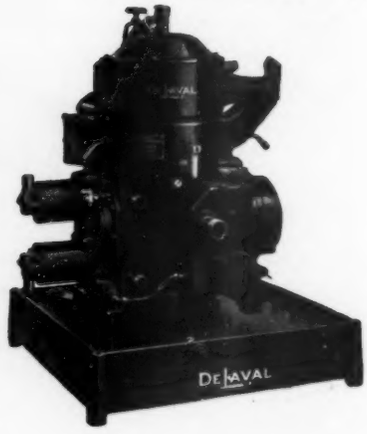
TURRET LATHES AUTOMATIC LATHES · BALANCING MACHINE

MOTOR CARS *or* MUNITIONS

"Hermetic" Coolant Clarifiers keep grinding coolant free of the tiniest metal particles and abrasive. Coolant is discharged under pressure, thereby eliminating foaming. Constant high clarifying efficiency assured on both aqueous and oil coolants.



The De Laval "Uni-Matic" oil Purifier is a self-contained purification plant in which are included built-in pumps, heaters, gauges, thermometer, sight glasses and all other equipment necessary to purify oil.



De Laval Direct Drive Centrifugals are built in a wide range of styles and sizes for various purposes and in capacities up to several thousand gallons per hour. Also available as portable units.

DE LAVAL Coolant

...DE LAVAL CENTRIFUGAL EQUIPMENT...

- **Increases Production**
- **Improves Finish**
- **Makes machines last longer**

Production Is Stepped Up—By keeping grinding coolants free from harmful abrasive and metallic sediment, De Laval Coolant Clarifiers make it possible to grind to closer limits and maintain fast cutting action of wheels over long periods. Finer finishes are produced. Coolant, whether aqueous or oil, can be used continuously with unimpaired efficiency and with a materially reduced infection hazard.

Higher Cutting Speeds Are Possible—Complete and efficient extraction of cutting oil from chips and turnings and purification of the oil through the use of the De Laval System permits higher cutting speeds and at the same time results in longer tool life. Cutting oil may be used indefinitely.

Finished Parts Are Protected—Purification of washing and slushing oils with De Laval Oil Purifiers insures the removal of impurities which are inevitably picked up, providing dirt —and moisture—free oil for coating parts. Oil in continuous systems can be used over and over again at full efficiency with assurance that it will furnish maximum protection against rust and be free from dangerous abrasive particles.

Machines Are Safeguarded — De Laval Oil Purifiers, by continuously removing metallic particles, grit and water from oils in central lubricating systems, maintain lubricants in a clean condition. Wear on running parts is minimized and machine life extended—important advantages today when new machines may be difficult or impossible to obtain and when shutdowns for repairs and maintenance must be avoided if high production is to be achieved.

Experience has shown that the De Laval purification of test block oil in automotive plants has made it safe to assemble motors into cars and trucks without removing pans after testing. Large savings of time and oil result from the application of this De Laval System.

* * * *

Take advantage of the long and varied experience of De Laval engineers in meeting and solving all kinds of oil clarifying and purifying problems. If you are concerned with removing impurities from honing oils, hydraulic press oil, vacuum pump oil, quenching and tempering oils, liquid coolants and lubricants involved in rolling, drawing, cooling, compressing and exhausting—consult De Laval and be assured of competent assistance. Write today for further information.

THE DE LAVAL SEPARATOR COMPANY

165 Broadway, New York 427 Randolph St., Chicago

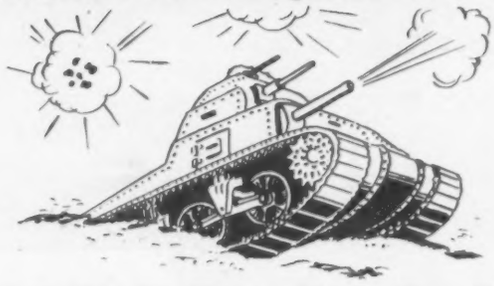
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco

THE DE LAVAL COMPANY, Limited

Montreal Peterborough Winnipeg Vancouver

Clarifiers...Oil Purifiers

To Finish The Job Quicker . . .



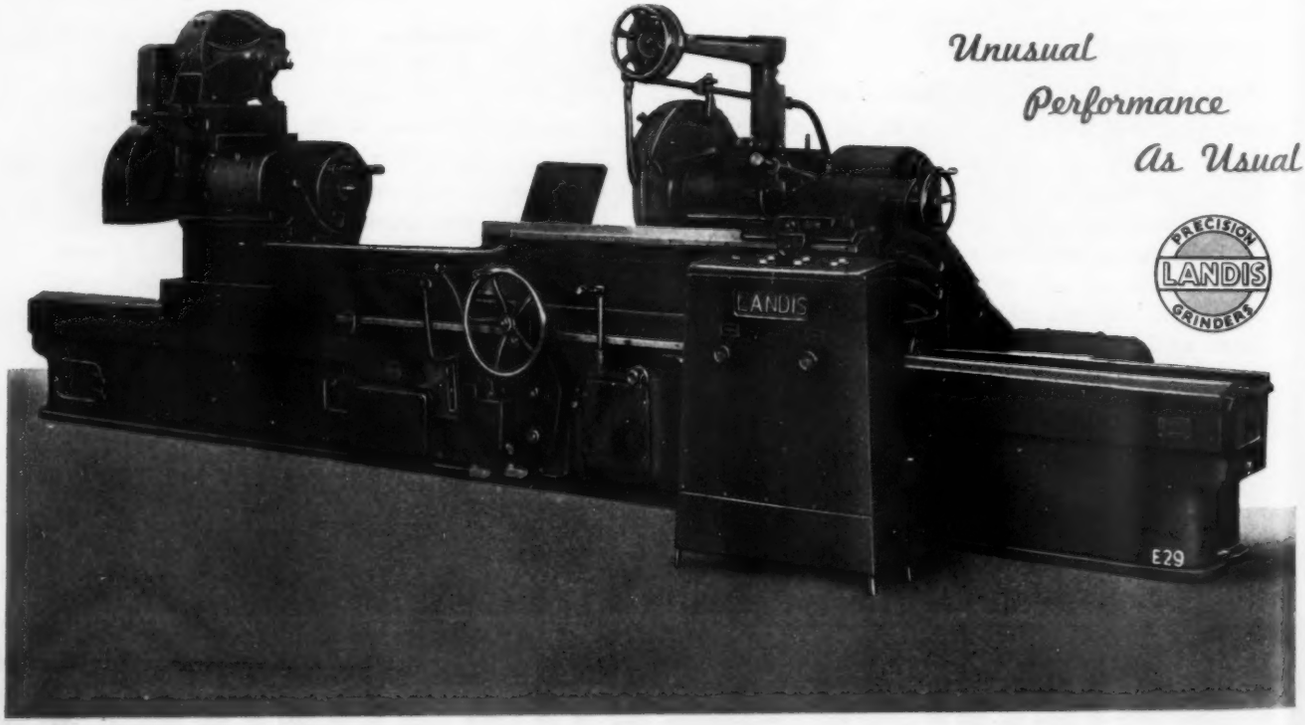
A TANK MANUFACTURER USES A LANDIS LIKE THIS

That valuable time can be saved by the proper choice of grinding equipment is illustrated by a large corporation engaged in the manufacture of tanks.

This corporation employs a Landis 16" x 96" Type B Plain Hydraulic Grinder with a gapped table for the grinding of tank gun rotors measuring 30" in diameter. Ordinarily such parts would require a machine of over 30" swing, however, because the rotors are short in length and are relatively light, and because the gapped table allows work as large as 40" in diameter to be accommodated they can be ground on the 16" swing machine.

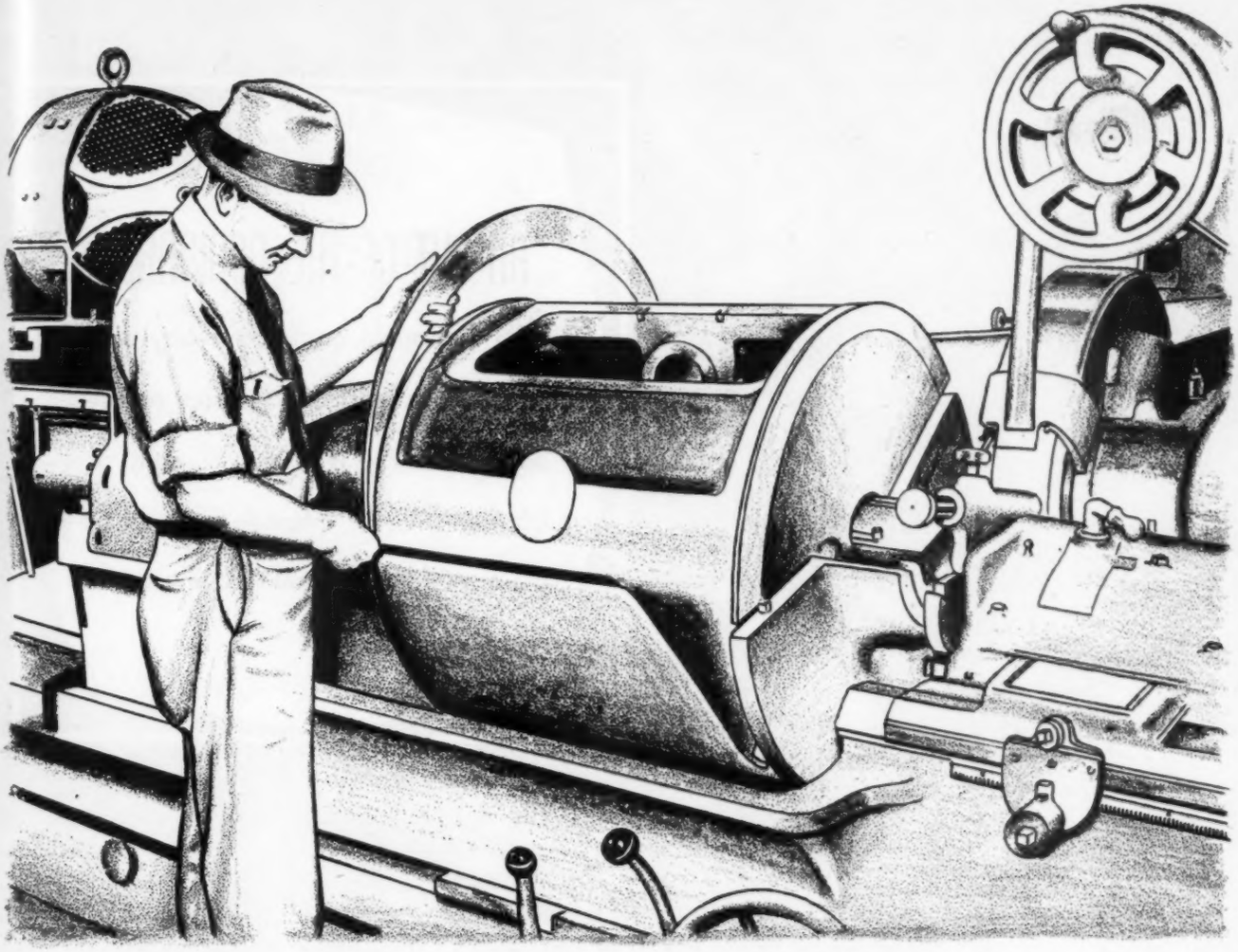
The time saving features of such an arrangement are obvious. On the 16" grinder handling time is reduced to a minimum because the work can be speedily set up with no waste machine nor space. In addition the very compactness of the machine plus the handiness of controls reduce operating fatigue and increase efficiency. Both short and long work with or without projections can be ground.

Why not avail yourself of many years experience in the field of precision grinding by asking Landis for recommendations. Then you, too, may find yourself benefiting from added grinder production.



Unusual Performance As Usual

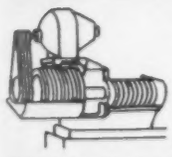
PRECISION LANDIS GRINDERS



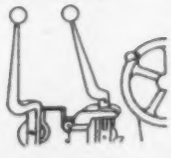
Above is shown the Landis 16"x96" Type B Plain Hydraulic Grinder now being used by a large corporation for the grinding of tank gun rotors. The work table is gapped at the headstock end to accommodate work 40" in diameter. The gap is 34" in width. When grinding, the rotor is mounted on a special fixture equipped with blocks on the ends to receive the centers of the headstock and footstock.

This 16"x 96" Type B is provided with a fill piece for the gap so that the machine can be used for grinding other parts when not being used to grind rotors.

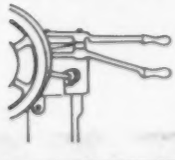
LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA.



MULTIPLE V BELT HEADSTOCK DRIVE

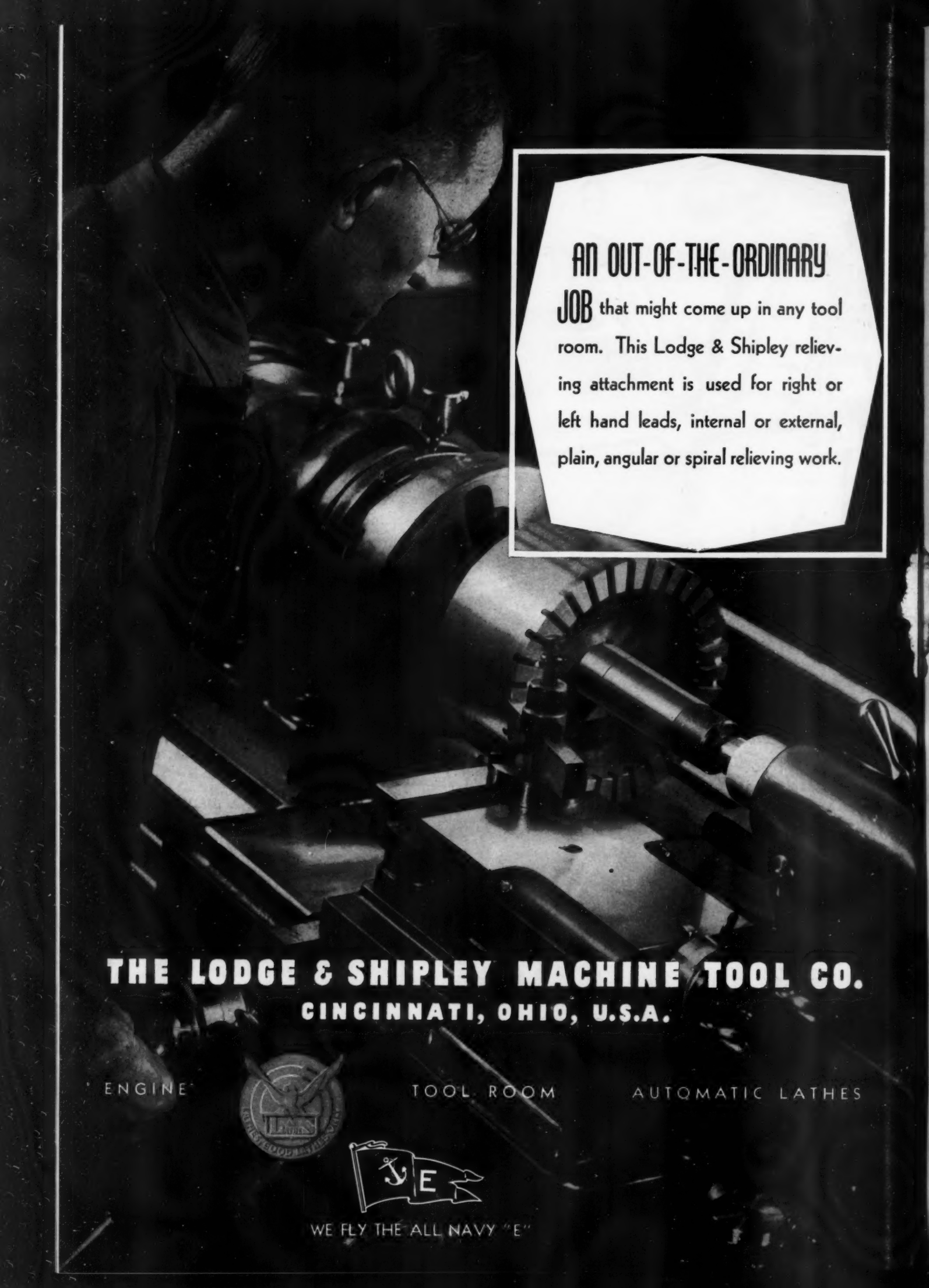


HYDRAULIC WORK TABLE TRAVERSAL WITH STEPLESS SPEED RANGE



RAPID ELECTRIC WHEEL FEED

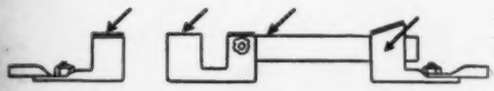
390


AN OUT-OF-THE-ORDINARY
JOB that might come up in any tool room. This Lodge & Shipley relieving attachment is used for right or left hand leads, internal or external, plain, angular or spiral relieving work.
THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI, OHIO, U.S.A.
ENGINE
TOOL ROOM
AUTOMATIC LATHES
WE FLY THE ALL NAVY "E"

TWO TO SEVEN FEWER PARTS PER POLE MEAN

fewer time outs

FOR WESTINGHOUSE TYPE A SAFETY SWITCHES



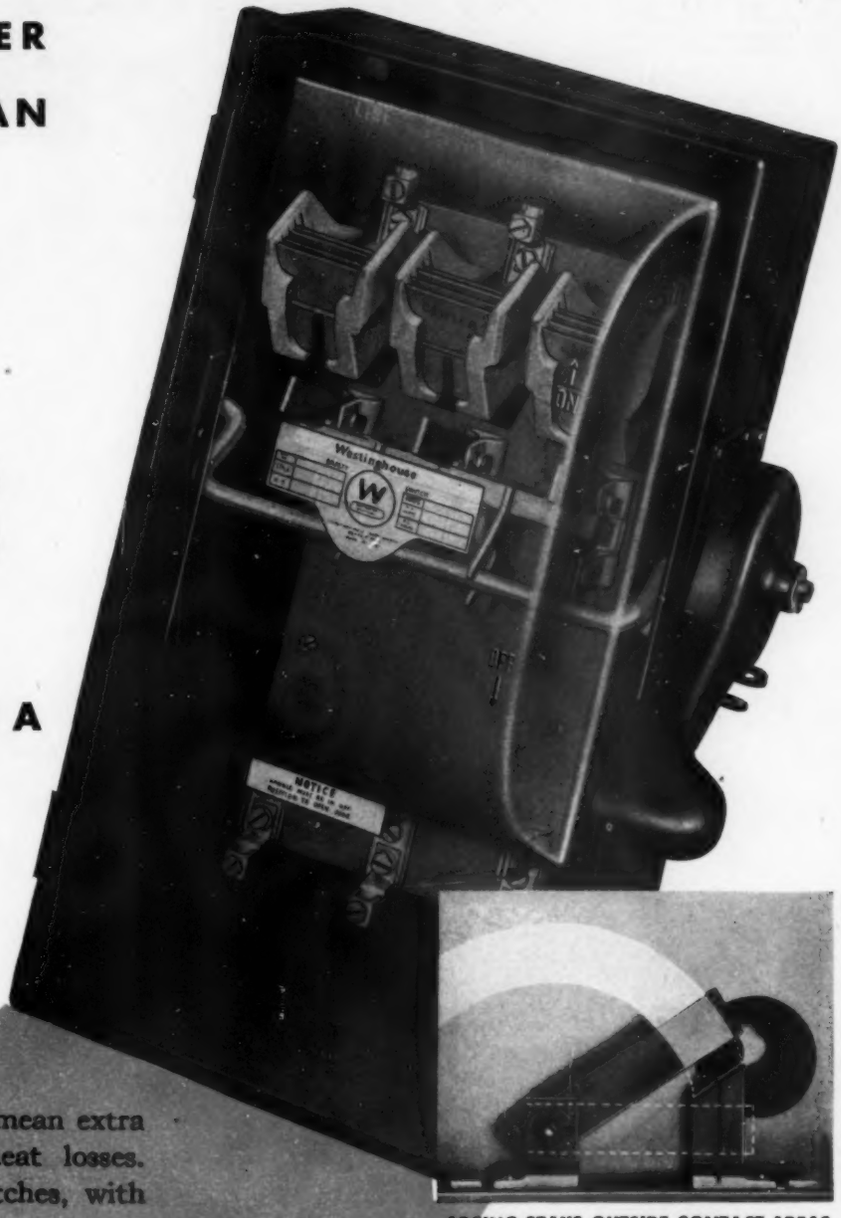
ONLY FOUR JOINTS PER POLE

Extra joints in current-carrying parts mean extra chances for loose connections and heat losses. That's why Westinghouse Safety Switches, with 2 to 7 FEWER joints per pole, save power . . . take less time out for maintenance and adjustments.

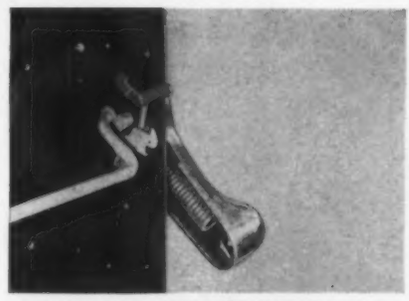
Westinghouse Switches stay on the job with less attention for two other reasons, too. One is the famous diamond-pointed jaw, which carries the arcing outside and beyond the contact area. The other is "De-ion" arc quenching action, provided on all 575 and 600-volt switches. No other switch offers these safeguards.

Give important production circuits this added protection. Call your nearest Westinghouse Agent for prompt service! Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

J-21184-A



ARCING STAYS OUTSIDE CONTACT AREAS—Blade extends beyond break jaw, which is diamond pointed. Arcing thus occurs outside contact areas, assuring clean contacts at all times.



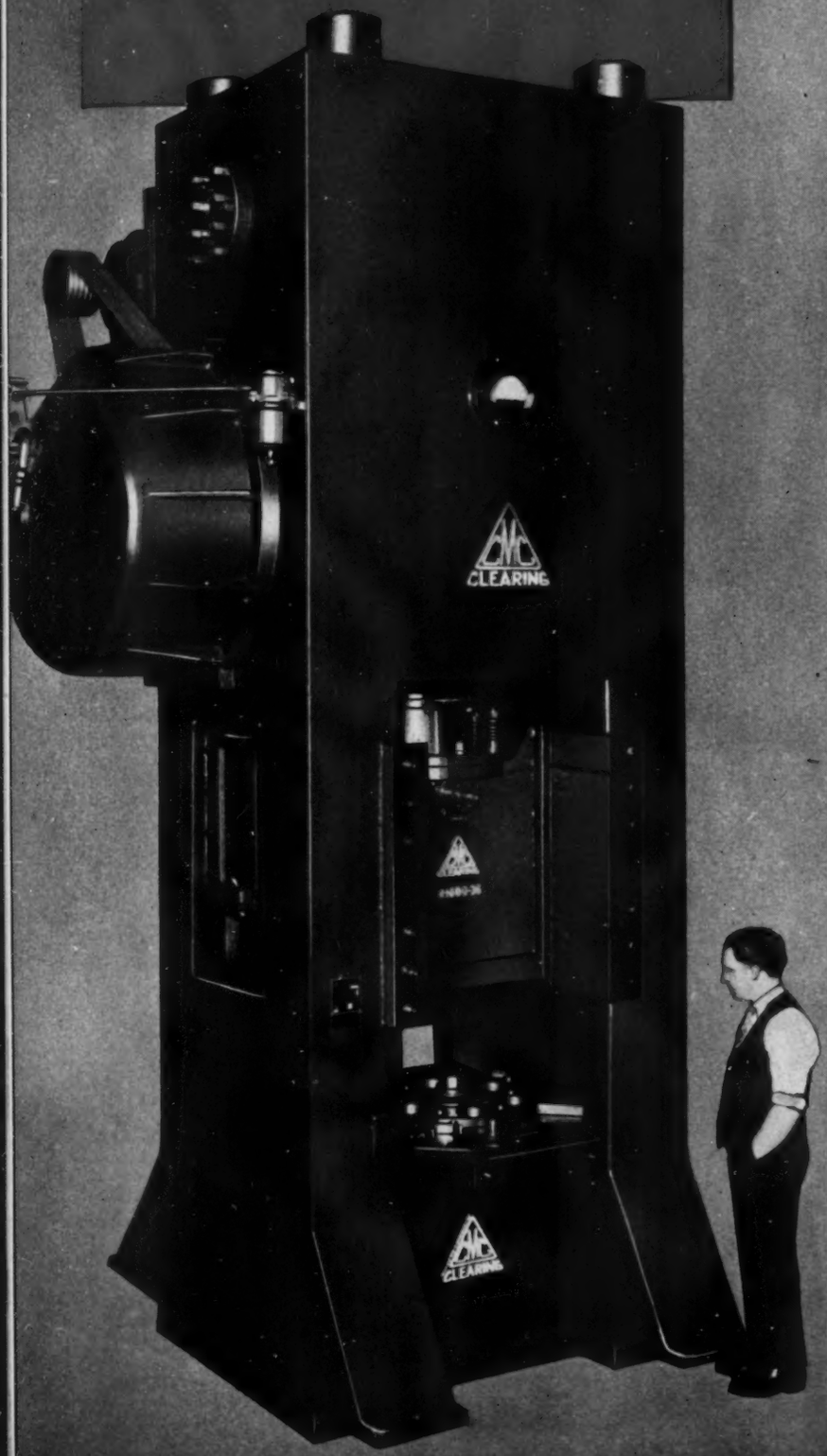
OPERATING MECHANISM OUTSIDE CABINET, away from wiring. This feature leaves more wiring space, prevents possibility of mechanism chafing against insulation or short circuiting.

WESTINGHOUSE

Westinghouse

CLEARING Mechanical
TO SPEED WAR

CLEARING MECHANICAL PRESSES for Manufacturing BRASS and STEEL Cartridge Cases



The Clearing Press illustrated is set up for the production of Cartridge Cases. The precision dial feed, within easy reach, features positive indexing which, in connection with Clearing's rigid construction and extra long slide guides, assures perfection in die alignment. Furthermore, the unit will cause the Press to stop automatically in the event of any emergency. Another feature, advantageous in Cartridge Case production, is the electrically controlled, air operated friction clutch and brake which contribute to completely dependable Clearing performances **at all speeds.** Clearing Mechanical Presses—now meeting with unreserved approval in munitions production—are available for making cartridge cases 20 m.m. up. Their wide application is a valuable contribution to America's Victory Program!

CLEA
MACHINE CORP.

and Hydraulic Presses
MATÉRIEL . . . . .

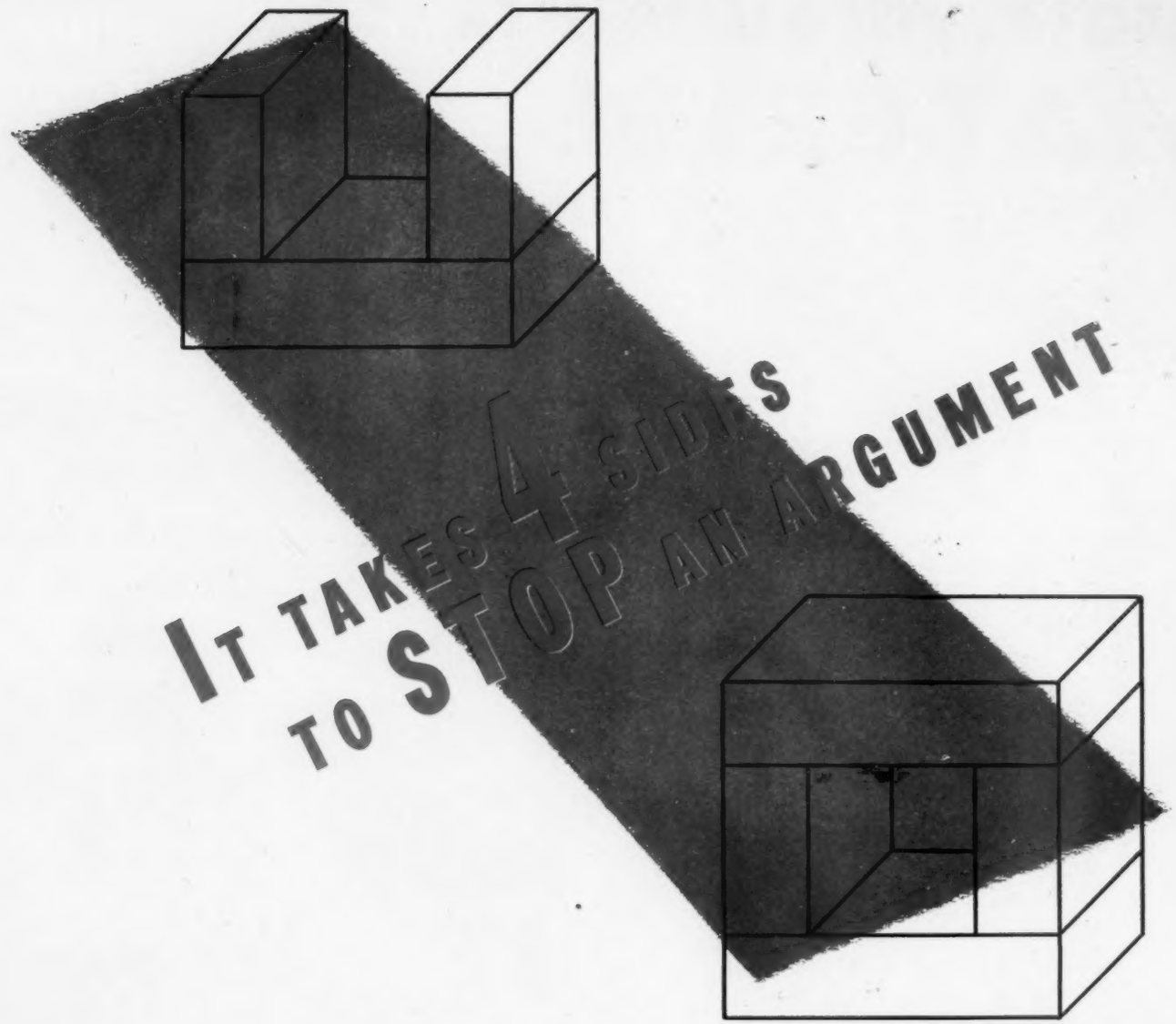
CLEARING

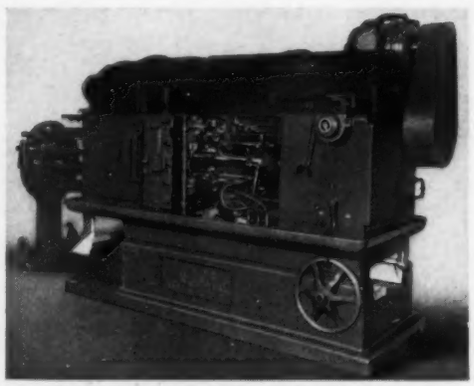
Shaping, Forging and Drawing metals into millions of parts for war machines, CLEARING presses share in this production with high speed action and efficiency. The Triple Action Press as pictured has rigid preloaded frame, adjustable gib guided slides, unusually large area for dies open on all four sides. Perfect die alignment is assured. The pressing cycles use full power by working the blank with stroke beginning fast when pressure is low then slowing down when pressure rises high. Change of dies as picture shows are made in shortest possible time. Maximum production output is result. The modern CLEARING lines of presses, Mechanical and Hydraulic are products of these modern times, and speed of production plus precision of die action are fundamentals in their design. They are thus an important contribution tc the Nation's high speed output of Victory Production of war materiel.

Your inquiry will receive prompt attention.

RING

CHICAGO





The red portion highlights an outstanding feature of Conomatic design —the cam shaft in the rugged top bed.

It takes four sides to stop the argument concerning accuracy and rigidity of multiple-spindle automatics.

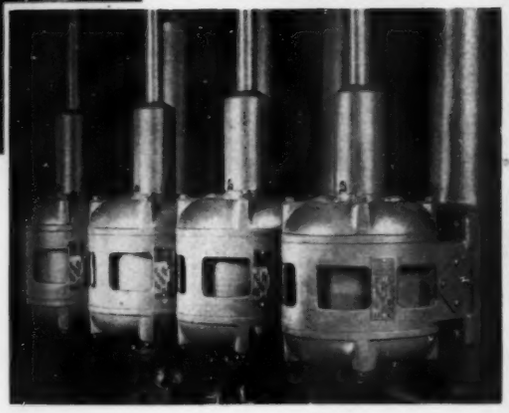
Conomatic design includes a heavy, rugged top bed that completes the all 'round support of the work area — *four sides of* heavy, rugged support for accuracy, rigidity and durability.

***All Conomatics* are readily identified by the overhead cam shaft in the top bed. This construction has a triple advantage — it strengthens the mounting of spindles, auxiliaries, slides and tools — it puts the cams overhead away from coolant, dirt and chips — it affords easy accessibility, resulting in quick changeovers.**

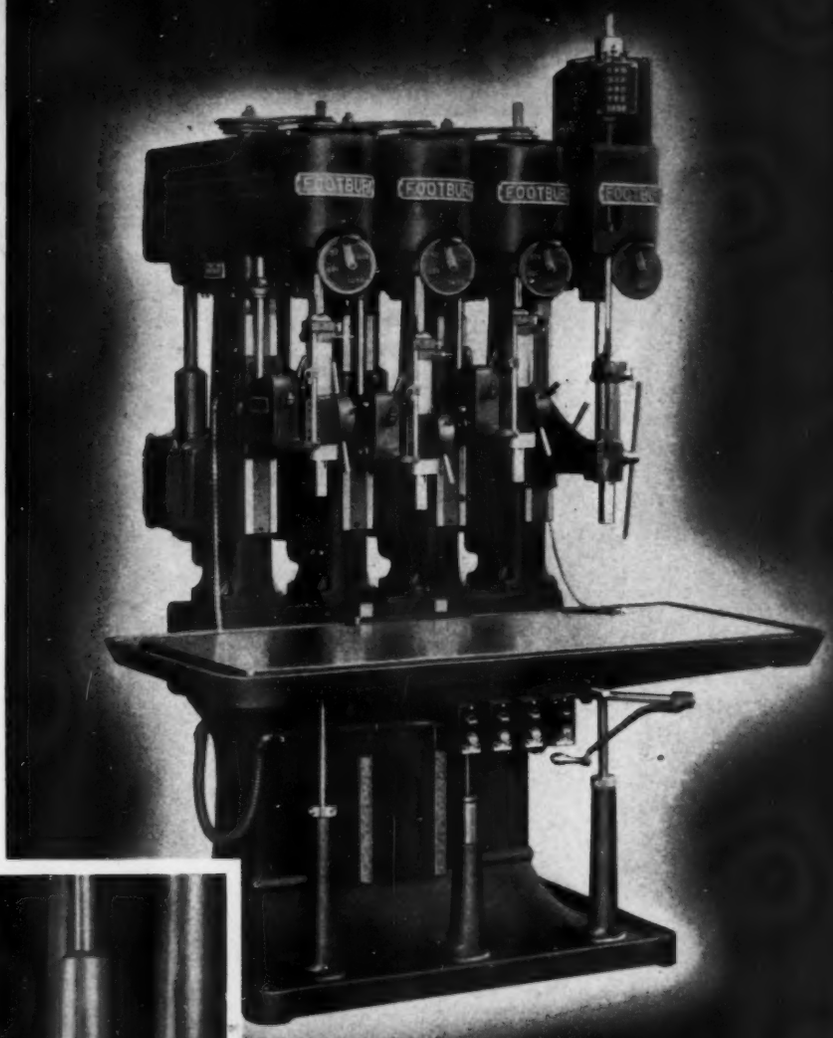
CONE AUTOMATIC MACHINE COMPANY INC.
WINDSOR, VT., U.S.A.

POWER FEED
FOR PRODUCTION DRILLING
AND REAMING

CONVENIENT
MAGNETIC
CONTROL
AVAILABLE



MOTOR DRIVE FOR ALL SPEED CHANGES
WITH STANDARD LOW-COST MOTOR



Full Range Drill

FOR

GREATER WAR PRODUCTION

TAPPING ATTACHMENT FOR
PRODUCTION TAPPING

BACK GEAR UNIT WITH
4 ADDED SLOW SPEEDS

• The choice of fine machine tools during this great emergency is an investment for future profits when products will have to be made with increased accuracy and efficiency.

Footburt sensitives are built with the wide range of speeds and with the power and sturdiness to handle work faster under present pressing times. They are built with the care and precision that will keep them accurate over a long period.

Footburt machines are tools for today—and tomorrow.

No. 2 Machine with Back Gear

8" or 12" Overhang • 5/8" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 R. P. M. • 280 to 3450 R. P. M. Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit

THE FOOTE-BURT COMPANY

CLEVELAND, OHIO

Detroit Office: 4-253 General Motors Building

FOOTBURT *Sensitive* DRILLING MACHINES

OHIO PRODUCTION MILLING MACHINES

Convenience and accessibility make the *Ohio Production Milling Machine* rapid in production, yet easy to set up for short runs. Powerful, true cutter rotation, rigidity, a true plane of travel and positive locked feed enable it to mill equally well *with and against the feed*, making possible continuous milling operations without indexing features. Climb-cutting lengthens cutter life. Various cycles of automatic operation of the feed and rapid traverse are available.

THE OHIO MACHINE TOOL COMPANY, KENTON, OHIO

Orders for Ohio Production Milling Machines are being shipped promptly.

OHIO DREADNAUGHT

HORIZONTAL BORING, DRILLING AND MILLING MACHINES · SHAPERS · PLANERS

HERE'S PEACE
for the minds of Key Production Men

P&W Photo—Unretouched

KEY men designed this engine block, planned the tooling, provided man power and materials. Would the job follow through on schedule?

They plotted this job *right* . . . on paper. One important question was — will the tools do the job? Accurately? Hour after hour . . . with no delays?

The chips you see there in mid-air are the answer. It's a Pratt & Whitney cutter . . . *accurately* selected for its job . . . *accurately* cut, *accurately* heat treated, *accurately* finished. It's brought peace to the minds of many key production men. Together with tens of thousands of other P&W cutting tools, it's building American strength for Victory . . . helping to bring a decisive peace to the world.

Work your P&W tools all day, all night; they can take it. And there are more where they came from . . . we're turning 'em out 24 hours a day.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

How to Conserve Stainless Steel and Increase War Production!

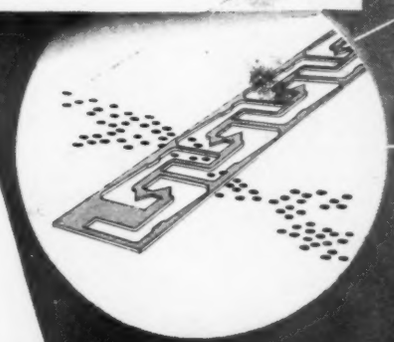
When you were turning out war equipment and parts in smaller numbers, Stainless Steel scrap losses in fabrication involved fewer pounds of vital metals. But now that output has leaped into mass production, scrap losses must be reduced to an absolute minimum.

With nickel and chromium so precious to our war needs, it is vitally important that you check your fabricating methods at every point. Waste is terrifically expensive in loss of time and strategic materials.

Helping to get the most out of every pound of Stainless Steel is a part of Carpenter's Wartime job. The knowledge and experience we have gained from pioneering the fabrication and use of Stainless Steels is now being offered to you. Let your Carpenter representative help you check your tools, dies and lubricants—to make sure your set-up is right for maximum production from a minimum of material. Meanwhile, here are specific suggestions to help you speed war production and conserve material. Be sure to check these points in your plant now! Time is short!

√Check your Scrap Losses

If you are blanking, forming or drawing parts from sheet, find out if using a narrow strip could eliminate slitting and reduce your scrap loss. One plant reported a 40% material saving by adopting strip to the specified width for the particular part. Jobs were laid out more economically, and time spent handling material was reduced. The accurate gauges and tolerances of Stainless Strip save wear on dies and reduce rejects.

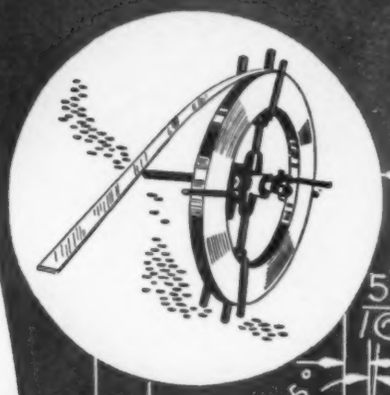


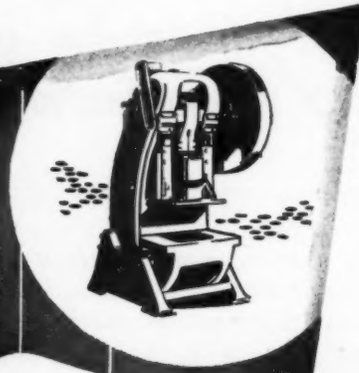
Carpenter

BRANCHES AT Chicago, Cleveland,

✓Check your Physicals

Find out if you can take advantage of the natural strength of Stainless by using a lighter gauge strip. Often, an embossed rib can be used to add strength, allowing the use of lighter gauge stocks. Still another way to speed war production is to make sure that each order to your supplier is complete—from physical specifications to priority information.





✓Check your Fabricating Speeds

Here again, the blanking, forming or drawing of parts can often be speeded by using Stainless Strip. You get it in coils, and because of accurate gauge—uniform tolerance —it feeds into the press automatically. Only correct press speeds boost production. A quick check-up may even show you that slower press speeds will enable you to increase output, reduce rejects, and get longer tool life.

✓Check your Rejects

If your rejects are high, it's time to start checking all along the line. Material too much undersize can cause wrinkling in the die. Oversize material may explain galling and tearing. Check your tool layouts, die clearances and lubricants. And if your scrap pile continues to show a high percentage of rejected parts—it's time to call in an expert.

THE CARPENTER STEEL COMPANY, 109 Bern St., Reading, Pa.

The Carpenter Stainless Selector Slide Chart can give you quick answers to your questions on the grades of Stainless to meet your requirements. It shows the machining, heat and corrosion resisting properties of each analysis of Stainless Steel. A note on your business letterhead will bring you a Slide Chart—free to Stainless Steel users in the U. S. A.

STAINLESS STEELS

Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

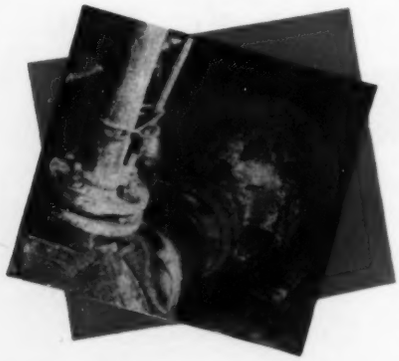
NEED MOTORS f

4 things to do t

use standard, open, sleeve-bearing motors whenever possible . .

The standard Tri-Clad motor, though classed as an "open" motor, is so well protected that it gives good service on many jobs for which specially protected motors previously were recommended. (See below.)

Sleeve-bearing motors often can be supplied more readily than ball-bearing types because of the present demand for ball bearings on other war equipment. Use ball-bearing motors only on applications where load or mounting conditions definitely require them.



Special end shields and other modifications may result in delay for you and others doing war work.

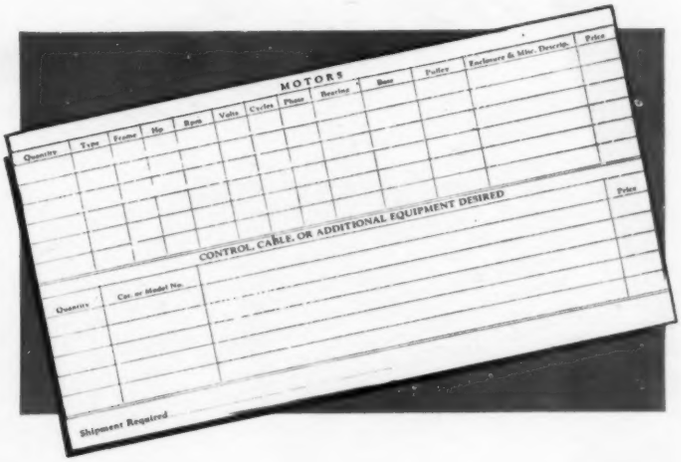
Consider the use of standard or multi-speed a-c motors in place of d-c wherever this alternative is possible.

order motors early . . giving complete specifications . .

Place motor orders when you order the machines they are to drive.

If you are planning motor drives for conveyors or other equipment for new plants, place orders as soon as design work indicates the motor requirements.

Avoid delay and "mix-ups" by giving complete specifications as shown in table below, preferably on an order form which your G-E motor representative can supply.



Tri-Clad motors are available in a full range of sizes from 1 to 100 hp. Your General Electric representative can supply complete information, and help you get the Tri-Clad motor to do your job. General Electric Co., Schenectady, N. Y.

YOUR AID ON THESE 4 POINTS WILL HELP US PRODUCE AND DELIVER MORE MOTORS

YOUR CHOICE OF G-E TRI/CLAD MOTORS WILL GIVE YOU EXTRA PROTECTION AGAINST (1) PHYSICAL DAMAGE, (2) ELECTRICAL BREAKDOWN, (3) OPERATING WEAR.

for WAR WORK?

to get them quicker

give complete priority information properly endorsed..

The filling of many motor orders is delayed because of incomplete priority information. If in doubt about details, call your local G-E office.

When placing orders for motors, be sure that complete priority data accompanies *each order* in the form of certificates, endorsements properly signed, etc. The priority is not effective in scheduling shipment until received by your supplier.

Your needs and the war effort are best served by using the proper priority rating as assigned by the War Production Board for the job involved and requesting delivery no earlier than actually required.

Builders of motor-equipped machines for subsequent sale may order their requirements in advance under the Production Requirements Plan.

check with G. E. for delivery from local warehouse stocks..

To meet urgent war needs, a supply of standard Tri-Clad motors is maintained at G-E factories and local G-E warehouses. Perhaps the motor you want, or can use with a few simple changes, is available for immediate shipment.

Your local G-E motor representative can furnish information on motors which may be in stock in the following cities:

Atlanta, Ga.	Los Angeles, Calif.
Boston, Mass.	Milwaukee, Wis.
Buffalo, N. Y.	Minneapolis, Minn.
Charleston, W. Va.	New York, N. Y.
Chicago, Ill.	Oklahoma City, Okla.
Cincinnati, Ohio	Omaha, Neb.
Cleveland, Ohio	Philadelphia, Pa.
Dallas, Texas	Pittsburgh, Pa.
Davenport, Iowa	Portland, Ore.
Denver, Colo.	St. Louis, Mo.
Detroit, Mich.	Salt Lake City, Utah
Houston, Texas	San Francisco, Calif.
Kansas City, Mo.	Seattle, Wash.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

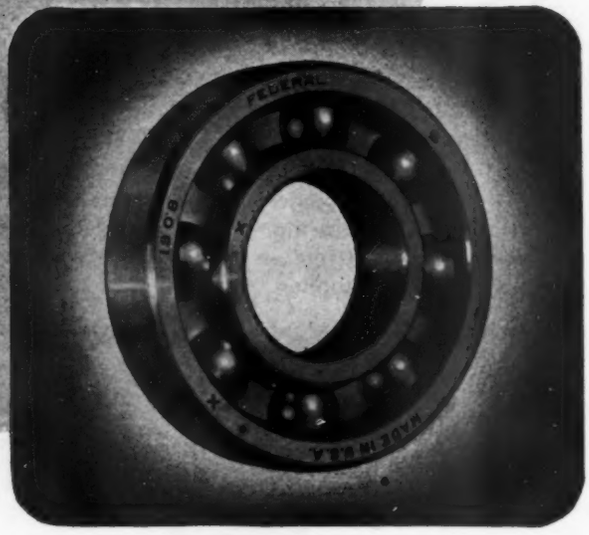
Specify TRI CLAD *Motors*

REG. U.S. PAT. OFF.

GENERAL ELECTRIC

QUALITY

TRADE MARK



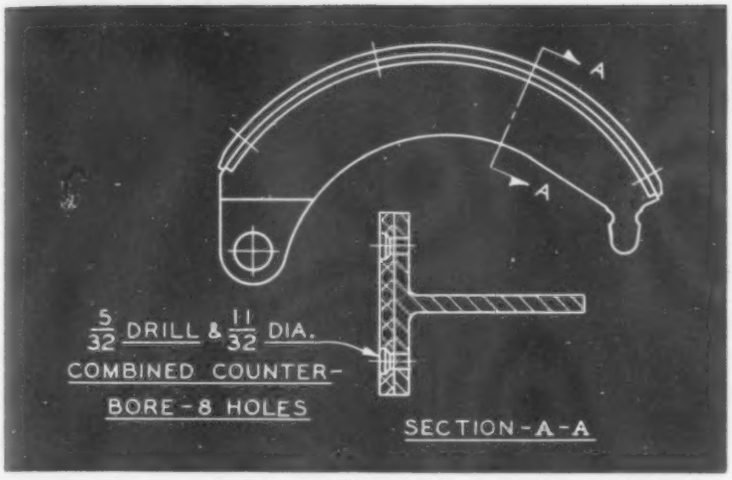
FEDERAL
BEARINGS

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

POUGHKEEPSIE, N. Y.

Detroit Office: 2640 Book Tower • Cleveland Office: 402 Swetland Building
Chicago Office: 902 S. Wabash Ave. • Los Angeles Office: 5410 Wilshire Blvd.

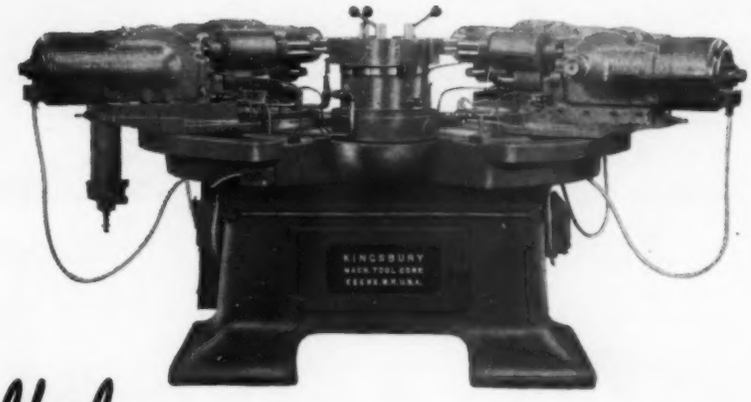


THIS IS A

FLEXIMATIC

AUTOMOTIVE JOB!

Brake Shoe and Lining Production Speedily and Accurately Handled



FLEXIMATIC

by KINGSBURY

One important advantage of the FLEXIMATIC is the fact that it is a machine providing automatic indexing for performing various machining operations in a single chucking of the work.

This method is specifically applied to the Model GD Eight-Spindle Fleximatic arranged for drilling and counterboring brake shoes and linings shown in the accompanying drawing. Many variations of the machine are available, some for linings only and others for shoes only.

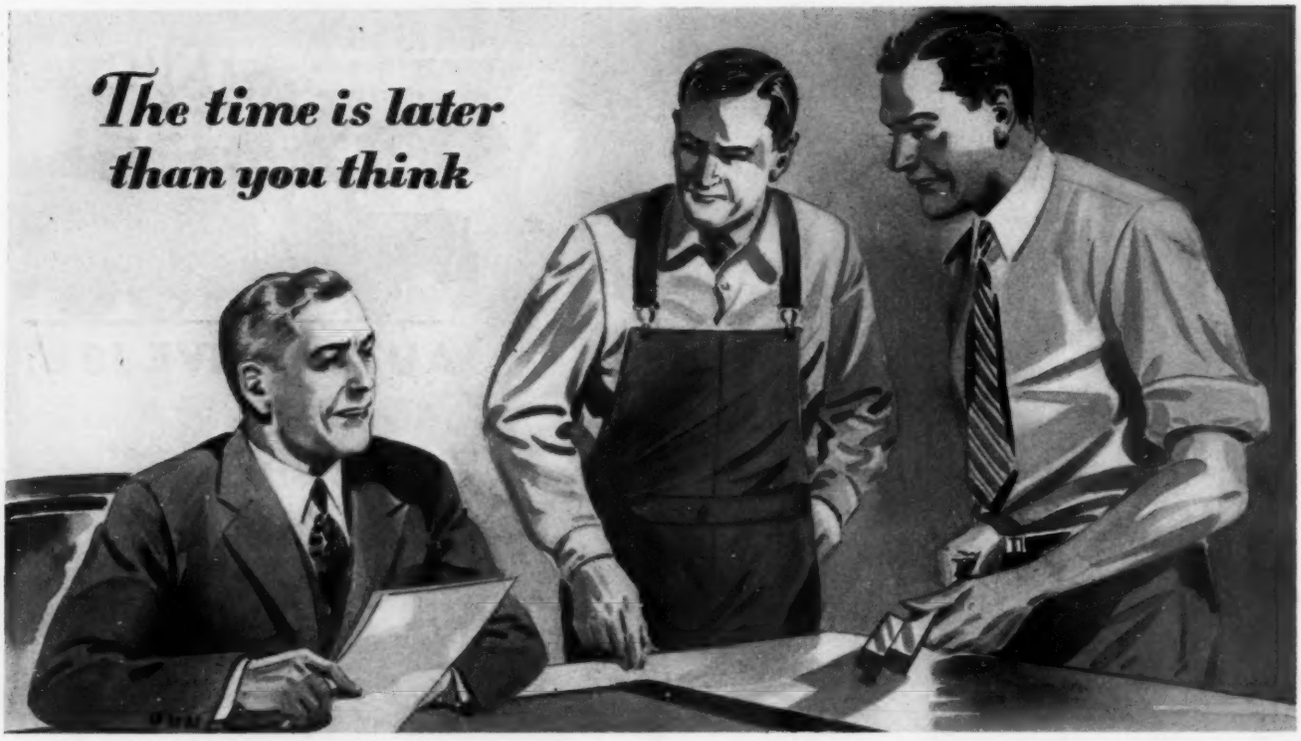
The FLEXIMATIC system, pioneered by Kingsbury, involves a single base on which is mounted an indexing turret and standard metal cutting units for each operation such as drilling, reaming, counterboring, etc. The turret is designed to receive a number of duplicate work holding fixtures and can be rotated intermittently under control of the operator for presenting fixtures to loading and working stations. While units are in action, the turret is locked securely. All automatic operations are performed simultaneously while the operator removes a finished part and replaces it with a rough part at the loading station.

Speed, accuracy and easy handling even by unskilled operators are inherent in the performance of FLEXIMATICS.

Write today for illustrated Bulletin showing a number of different set-ups

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A



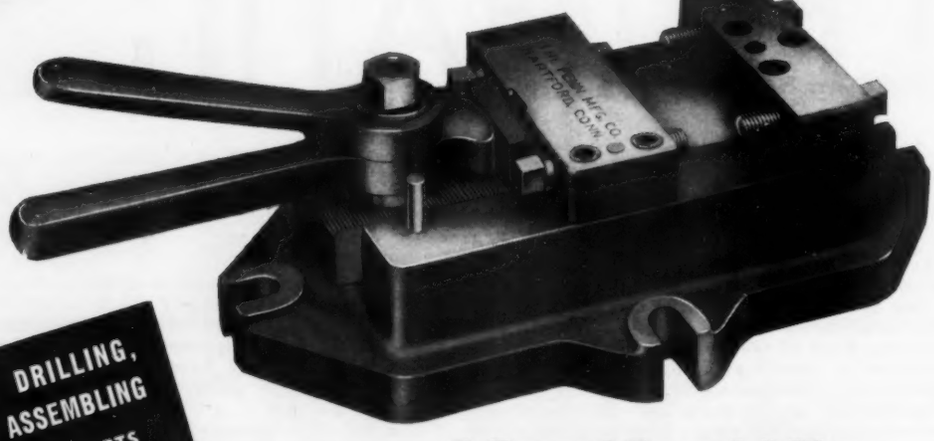
Find a Way to Handle Small Parts Production Faster, and you get rid of a big Headache

FENN

QUICK ACTION VISES

Quick on the trigger—Fast on the reload

Three Sizes
4" - 5" - 7"



FOR MILLING, DRILLING, TAPPING, AND ASSEMBLING

AIR PLANE ENGINE PARTS
MACHINE GUN PARTS
AUTOMOBILE PARTS
ELECTRICAL EQUIPMENT
TOOL MAKING
PRECISION INSTRUMENTS
COMPENSATORS, ETC.

A Rugged Powerful Vise
Known in every Gun Plant in America
Send for Bulletin No. 10

The FENN MANUFACTURING CO.
Established 1900 HARTFORD, CONNECTICUT

Pushing More Tools to Machines of War . .

FOSDICK
JIG BORER

• With each new war production machine installed there must be a complete tool set-up or jigs or fixtures to insure the maximum output from each machine.

In and about one of our largest industrial centers Fosdick Jig Borers are doing a major job in Tool & Die Shops engaged in producing dies—jigs—fixtures and special tools for America's machines of war.

Illustrated is a Fosdick Jig Borer in one of these shops. The all-around utility and dependable accuracy of the Fosdick Jig Borer is indispensable on this type of work. Its economy on both production jobs and short runs is also worth investigating.

●

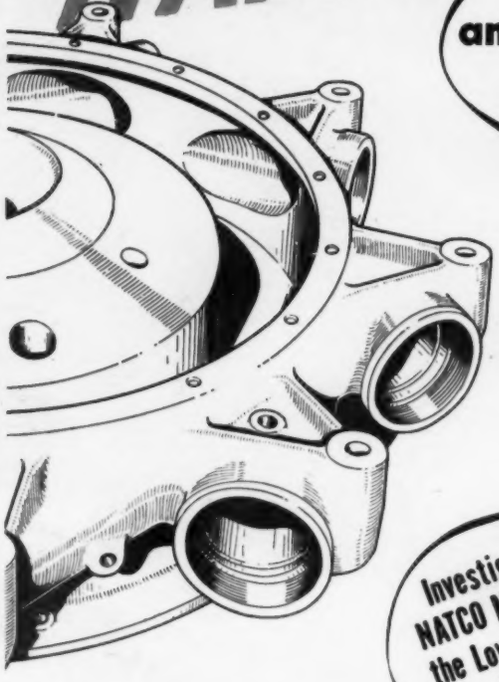
FOR FULL DETAILS WRITE FOR JIG BORER BULLETIN J.B.A.

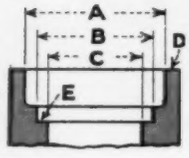
Built in two sizes the 30 and 30A

●

FOSDICK MACHINE TOOL COMPANY
CINCINNATI . . . OHIO

NATCO 5 WAY AUTOMATIC BORING and TAPPING MACHINE... BOOSTING AIRCRAFT PARTS PRODUCTION





This NATCO 5-way automatic machine is helping one of America's largest automotive companies step up production of aircraft parts for Victory. At the push of a starting button, blower crankcase sections are carried through an automatic cycle involving 14 indexes. Nine bosses on the periphery are machined, including for each boss . . . (1) combination rough bore A and B and face . . . (2) combination finish bore B and finish face D . . . (3) combination semi-finish bore A, rough bore C and rough face E . . . (4) combination finish bore C and face E (5) . . . tap A.

This tremendously versatile NATCO Automatic is typical of NATCO products at work for Victory in Defense plants throughout American Industry. Consult NATCO on your drilling, boring and tapping problems. NATCO engineers will gladly assist your tool engineers.

Investigate NATCO Methods for the Lowest Possible Hole Costs!

CHICAGO: 1809 Engineering Building
DETROIT: 409 New Center Building
BUFFALO: 1807 Elmwood Avenue
NEW YORK: 2902 Commerce Building

NATCO SOLVES YOUR HOLE PROBLEM

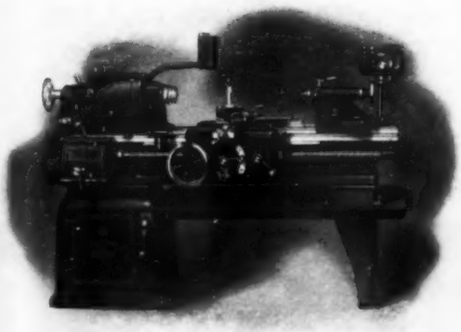
NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND.

DRILLING, BORING and TAPPING MACHINES

TOOLING FOR WAR PRODUCTION

Back of the plane and tank and gun — back of our entire war program — stands the man behind the machine. In the toolroom of a large aeronautical plant this craftsman at a South Bend Lathe is doing his part in defending America.

The Man Behind – the Man Behind the Gun!



IN TIME OF WAR, the man behind the machine is just as important as the man behind the gun. Back of the production lines of every war industry is our first line of defense — the toolroom. Here, where precision is of utmost importance — where tolerances are reckoned in split-thousandths—you will find South Bend Lathes.

Modern in design, built with extreme precision, South Bend Lathes are fast and accurate on the most exacting classes of toolroom work. Their wide range of spindle speeds permits machining with maximum cutting tool efficiency. Their versatility facilitates quick change-over through a minimum of set-up time.

South Bend Lathes are made in five sizes: 9″, 10″, 13″, 14½″, and 16″ swing, with toolroom or manufacturing equipment. Write for catalog and the name of the dealer nearest you.

SOUTH BEND LATHE WORKS

226 EAST MADISON STREET, SOUTH BEND, INDIANA, U. S. A.

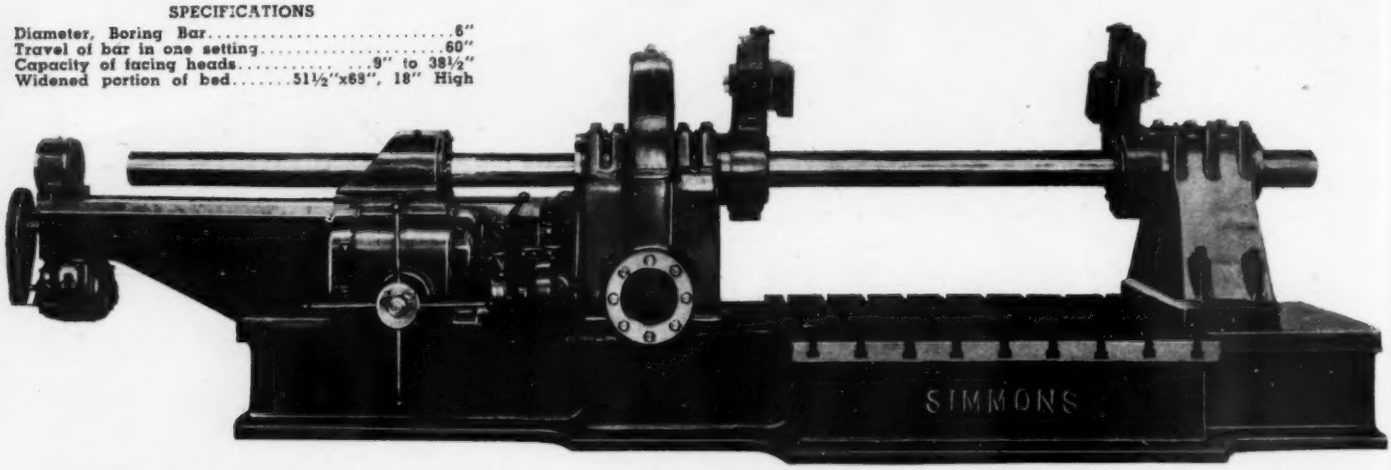
LATHE BUILDERS FOR 35 YEARS

LET'S GO! U.S.A. KEEP 'EM FLYING

SPEED PRODUCTION ON WAR CONTRACTS with ...

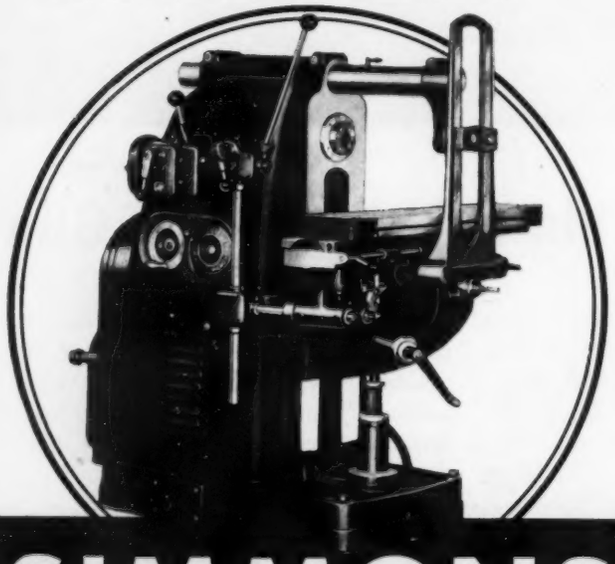
SPECIFICATIONS

Diameter, Boring Bar.....6"
Travel of bar in one setting.....60"
Capacity of facing heads.....9" to 38½"
Widened portion of bed.....51½"x69", 18" High



6" BAR HORIZONTAL BORING AND FACING MACHINE

Available with or without center section of bed, Simmons new 6" Bar Horizontal Boring and Facing Machine has been designed for high-speed, high-precision war work. Equipped with Simmons Micro-Feed Unit, an infinitely variable transmission, this boring machine offers both fine and coarse feeds ranging from .004" to 1.000" per revolution of spindle. The main drive to the boring bar is obtained through a six-speed gear box, motor-driven. Gears are of high-carbon steel and mounted on spline shafts with anti-friction bearings running in oil. Power Rapid Traverse to bar in both directions. Bed is of massive construction, heavily ribbed to insure maintained alignment.



SIMMONS No. 1A MILLING MACHINE

Today's intricate weapons of war call for small precision parts in tremendous quantities. Simmons 1A Miller is designed for that kind of production.

Equipped with Micro-Speed Drive, Selector Dial Control and Spindle Brake, Simmons No. 1A Milling Machine offers a wide speed range (56 to 630 R.P.M.).

SPECIFICATIONS

Speeds, 56 to 630 R.P.M. Range of Feeds: Longitudinal, 34"; Cross, 8"; Vertical, 18½".

SIMMONS MACHINE TO

SIMMONS

MICRO-SPEED

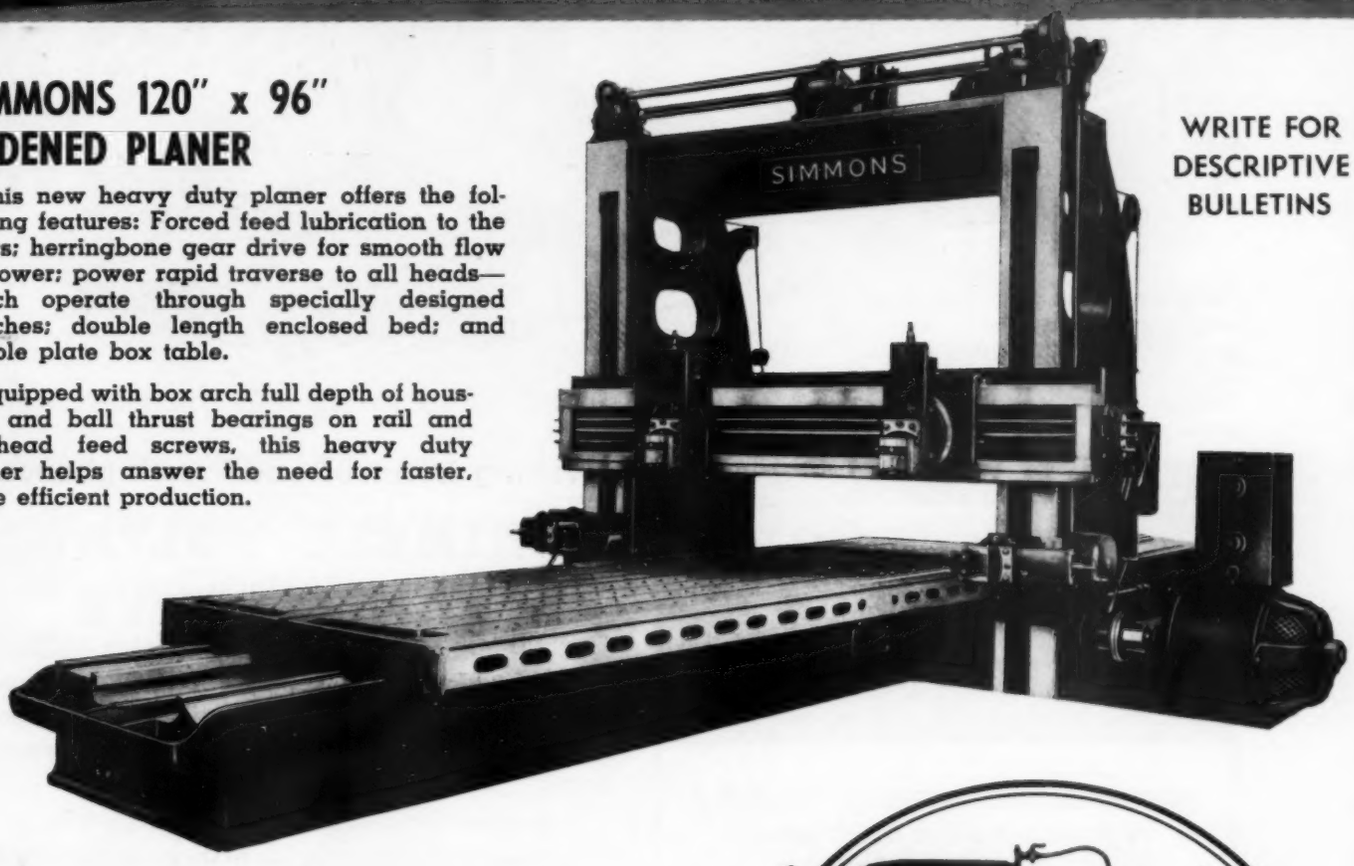
REG. U.S. PAT. OFF.

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES

SIMMONS 120" x 96" WIDENED PLANER

This new heavy duty planer offers the following features: Forced feed lubrication to the ways; herringbone gear drive for smooth flow of power; power rapid traverse to all heads—which operate through specially designed clutches; double length enclosed bed; and double plate box table.

Equipped with box arch full depth of housing, and ball thrust bearings on rail and sidehead feed screws, this heavy duty planer helps answer the need for faster, more efficient production.

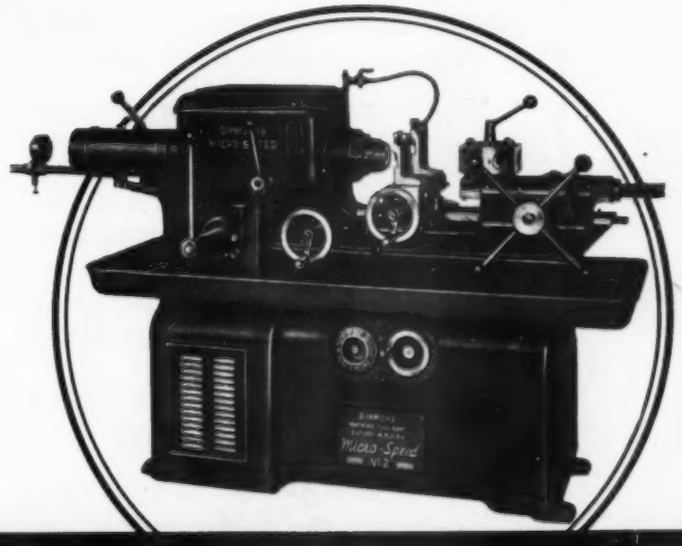


WRITE FOR DESCRIPTIVE BULLETINS

SIMMONS No. 2 TURRET LATHE

Simmons No. 2 Turret Lathes are being turned out at our plant in increasing numbers, thanks to our expanded production program, and are taking their places in many of our leading armament and aircraft plants.

Equipped with Micro-Speed Drive, Selector Dial Control, Spindle Brake and Clutch, Timken Tapered Roller Bearings.



SPECIFICATIONS

1¼" Bar Capacity; 14" Swing; Back-Geared machine illustrated. Built in Plain and Back-Geared Types.

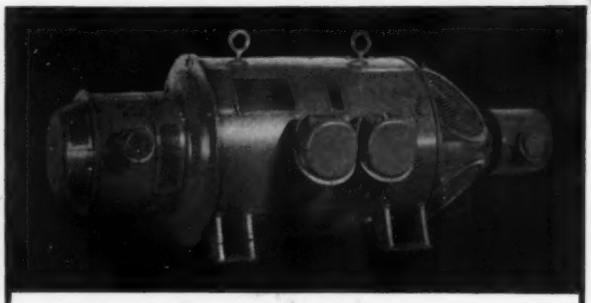
TOL CORP.

1759 BROADWAY, ALBANY, N. Y.
NEW YORK OFFICE: 149 BROADWAY

"36½% SAVED IN MACHINING TIME"

(increase varies with type and kind of job—may be more or less)

FOUR-IN-ONE unit. Induction motor, variable voltage generator, exciter generator and ROTOTROL are all compactly mounted on a single shaft. Separate cabinet houses simple control panel.



WHAT THE WESTINGHOUSE VARIABLE VOLTAGE PLANER DRIVE DOES

- Gives more *cutting strokes* per minute —gives faster acceleration and deceleration—*speeds reversing time.*
- *Reverses accurately to a line*—provides accurate control for planing up to shoulders or in blind pockets.
- *Provides constant speed* at any setting over entire range, regardless of voltage or load fluctuations.
- *Cuts machine outages* for control maintenance.

...using Rototrol and Westinghouse

VARIABLE VOLTAGE PLANER DRIVE

"36½% of the machining time formerly spent on this job has been saved by substituting Westinghouse Variable Voltage Drive for the conventional reversing motor."

This report from the owners of the above 48″ x 16″ Gray open-side planer is typical of the results obtained with this simpler, faster, more accurate control.

Thanks to Westinghouse ROTOTROL—the versatile control scheme that permits faster acceleration and deceleration—the Westinghouse Variable Voltage Drive can speed up the reversing action of the table, stop it at the precise same point every time, and give MORE cutting strokes per minute. Wider speed range (40 to 1200 planer motor rpm) permits use of the most efficient cutting and return speeds to fit the job.

Get the full details on this perfected and proved production booster! Ask your Westinghouse representative for B-3064. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

J-21202

Westinghouse VARIABLE VOLTAGE DRIVES

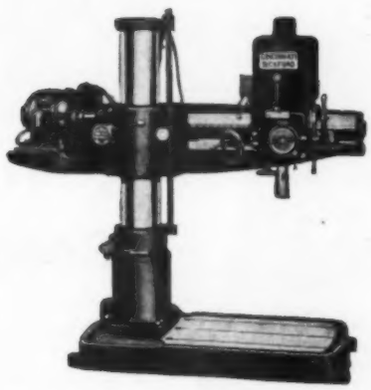
The Cincinnati Bickford

SUPER SERVICE

Upright and Radial

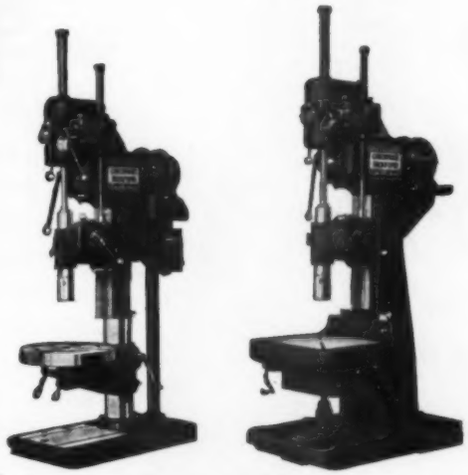
METAL DRILLING MACHINERY

Productivity, Capacity, Adaptability, Reliability, Accuracy, Convenience and Economy are the intangible components that give the Cincinnati Bickford line of drills the appropriate name of SUPER SERVICE. Examine the possibilities of the machines shown here and for further information send for any or all of the bulletins pertaining to the machines that interest you.



3' OR 4' ARM RADIAL WITH
9" COLUMN
BULLETIN R-21-A

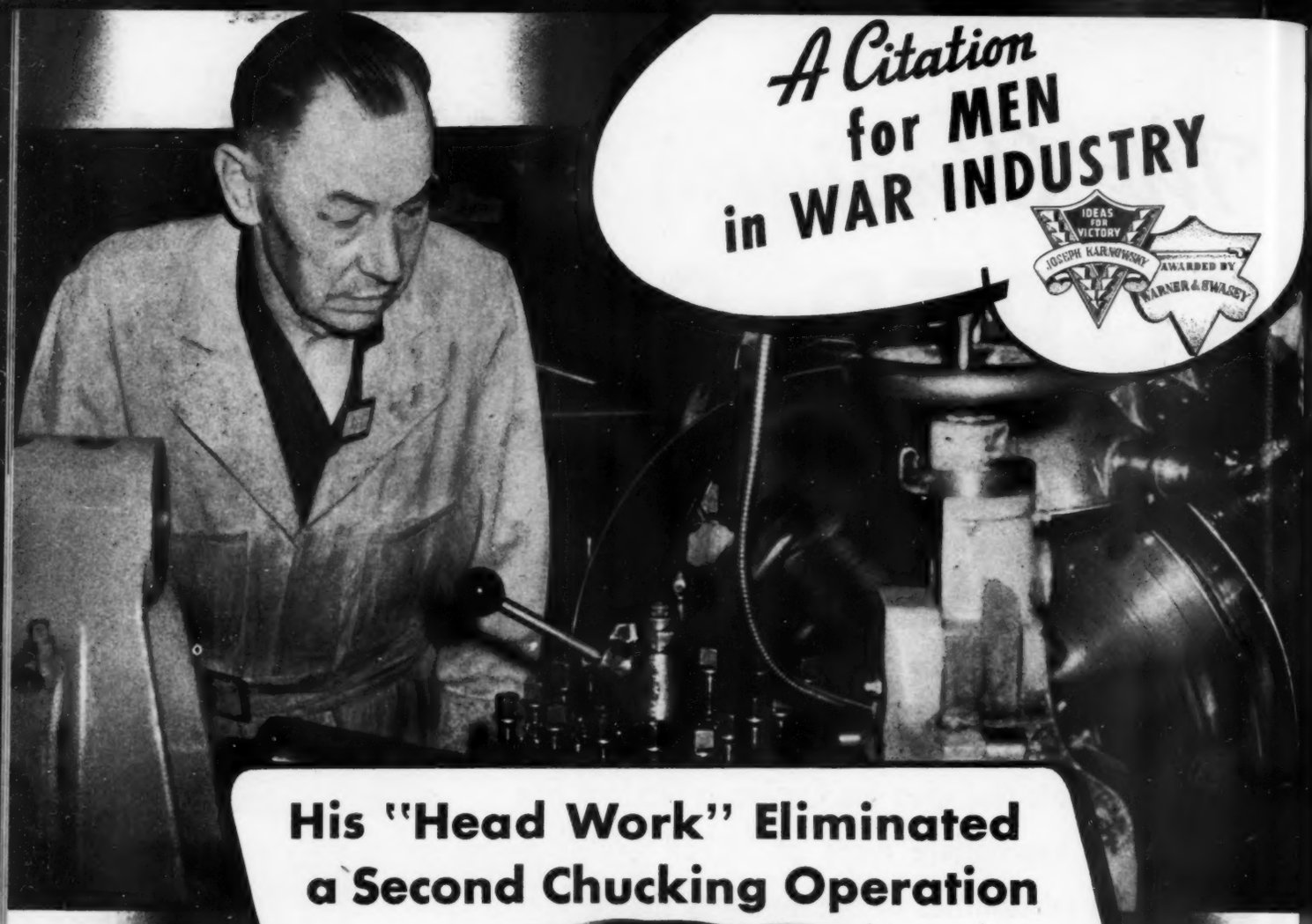
4' ARM 13" COLUMN TO
8' ARM 19" COLUMN
RADIALS, BULLETIN R-24



21", 24" & 28" ROUND AND BOX
COLUMN UPRIGHTS
BULLETIN U-25

THE CINCINNATI BICKFORD TOOL CO.

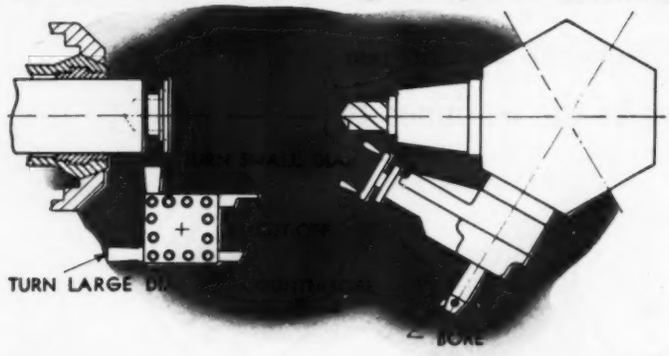
OAKLEY, CINCINNATI, OHIO, UNITED STATES OF AMERICA



A Citation for MEN in WAR INDUSTRY

IDEAS FOR VICTORY
JOSEPH KARNOWSKY
AWARDED BY WARNER & SWASEY

His "Head Work" Eliminated a Second Chucking Operation



Joe Karnowski mans a turret lathe in the Strut Department of *Bendix Aircraft,* South Bend, Ind. Along came a complicated collar job with the routing book calling for two chuckings. But operator Karnowski, like thousands of other skilled mechanics, thinks beyond routine work sheets. By rearranging the tooling, he was able to finish the work in *one* chucking, saving valuable time otherwise spent in rechucking for a second operation. The finished piece is also more accurate because in a single chucking all faces are square and the hole concentric. We are proud to present operator Karnowski with a gold victory pin for his contribution to "Ideas for Victory".

Hundreds of resourceful operators send their "Ideas for Victory" to be published in "Blue Chips", a newsy shop bulletin sent free to turret lathe operators' home addresses. Make sure *your* operators—old timers and learners—are on the list to get "Blue Chips". They'll enjoy it and profit through reading it. Write Warner & Swasey, Cleveland, Ohio.

Ideas for **VICTORY**

...from the Production [illegible] behind the Firing [illegible]

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

WARNER & SWASEY
Turret Lathes
Cleveland

WHAT'S IN THIS ISSUE

NOWHERE ELSE has so big a war load been put on a single industry as in the automotive field. Its commitments for war material total $14,000,000,000 a year—a production rate never even remotely approached during any year when motor cars were being made. At the start of '42 automobile manufacturers had to abandon the building of passenger cars for the war's duration. They began immediately to tool up for production of tanks and planes and shell and hundreds of war items. Many companies, in fact, had gotten into manufacture of defense products as long ago as 1940. How these companies, whose managements are masters of the art of mass production, have converted their plants and equipment is a fascinating story in itself. But it is more than an interesting tale; it is of practical value to companies in other industries which now are going over 100 percent to war operations. That's why we have devoted this entire issue to describing the transition of a whole industry from motor cars to munitions.

OLD MACHINES INTO NEW

Automobile makers didn't have time to wait for all new equipment to be delivered before plunging into manufacture of war implements. They looked over the machine tools on hand, selected what seemed suitable and retooled them for the new jobs. Sometimes machines were completely rebuilt. Chrysler did an outstanding job of machinery conversion. Its story begins on page 549.

AIRCRAFT ENGINES

What happens when a company goes over from manufacture of automobile engines to building aircraft engines? Cadillac can give you the answer, so far as certain aircraft engine parts are concerned. Look on page 578.

SIX-WHEELERS

Big six-wheel military trucks and other mobile equipment are just as much needed in wartime as guns and shell and planes. The logical place to make them is in the automotive industry, which has been turning out commercial trucks for many years. Yet you can't shut down a commercial truck line today and have military six-wheelers come off it tomorrow. The retooling which has to be done is extensive. Studebaker found that out. See page 605.

MAKES FUSELAGE SECTIONS

Hudson is doing several important war jobs for Uncle Sam. One of them is to produce parts for aircraft engines. Another is to provide the management and personnel for the Detroit Navy Arsenal. Still another is to make fuselage sections for bombers. On page 595 begins an account of Hudson's war program.

RETRAINING MEN FOR WAR WORK

The making of automobile bodies bears only slight resemblance to the production of armament. That is why existing buildings and manpower often are the major salvageable items in converting from peacetime to wartime activities. Fisher Body realized that fact. Upon being assigned important war work, it began immediately the retraining of supervisors and of men. It has accomplished important results, as the reader will see on page 586.

FARMS OUT 462 PARTS

When it started to make guns, Oldsmobile wanted to get going quickly. It knew that the fastest way to secure action would be to subcontract as many gun parts as possible. Accordingly it farmed out some 462 out of 471 parts of these guns, with notable results. Oldsmobile had other problems too in going over to munitions manufacture. On page 588 its problems and the answers to them are set forth.

IMPROVED METHODS

Chevrolet for many years has been the largest manufacturer of passenger cars. Its facilities are far flung. It is engaged in several vital armament manufacturing projects for Uncle Sam. How it has changed over its facilities and equipment is a book in itself. A careful appraisal of what it has done starts on page 581. It is worth a close reading.

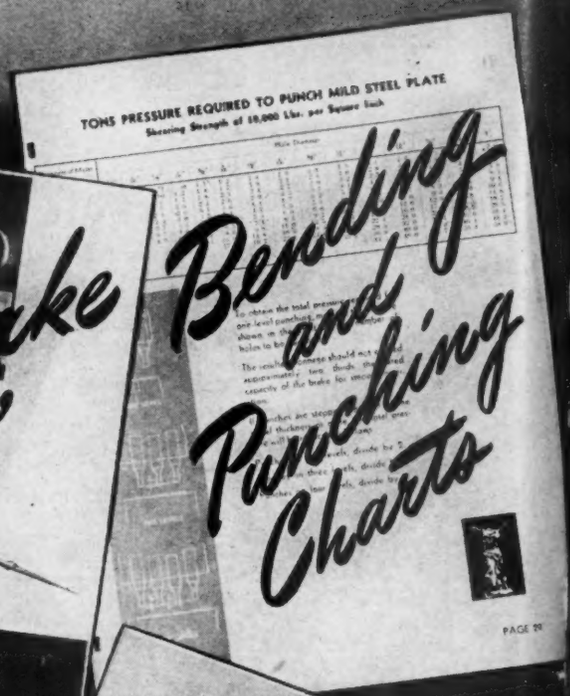
HOW FORD DOES IT

Watch Ford for new methods. That always has been true in the automobile industry. Now that the product is armament instead of V-eights, new methods still are in the foreground. Ford's conversion to war work is of interest to all companies faced by the problem of plant and machinery conversion. Starting on page 562 is the account of what Ford is doing and has done to tool up for the big job ahead.

COMING

A leading machine tool builder recently went from two long shifts to three shifts on a round-the-clock basis. It completed this difficult transition quickly and has sharply boosted its man-hours and machine-hours worked. To make a success of its program of continuous operation, seven days a week, it has based its policy on four fundamental points. These points will be discussed in an article in the next issue. In fact, the whole story of how the company made the changeover will be told. Look for it.

NEW CATALOG



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Motor Cars to Munitions

* * * America's biggest and most spectacular mass-production industry has been busy around the clock for many months transforming itself into Democracy's No. 1 arsenal – with notable results for Uncle Sam

AMERICAN MACHINIST · JUNE 11, 1942

Motor Cars to Munitions

AMERICA has a powerful trump which it is now playing in its battle to secure superiority in war weapons over its enemies. That trump is the automobile industry. It is the kind of trump that, fortunately for Uncle Sam, neither Hitler nor Mussolini nor Hirohito possesses, either singly or in combination.

Since early in January the automobile industry has been hard at the armament production task set for it by the Army and the Navy. Nineteen forty-two had scarcely come in when automobile manufacturing as such became a war casualty, and motor car assemblies were ordered suspended for the duration.

The industry which, above all others, typifies mass production has been in the process of being transformed at top speed into America's No. 1 arsenal. Round the clock, seven days a week, thousands of workmen and shop officials have been busy literally ripping apart the finest industrial structure in the world and building in its place a new manufacturing establishment dedicated to the task of making guns and tanks and planes and shell in unheard of quantities.

The hum of automotive machinery and the confusion of noises along motor car assembly lines hadn't died out before machinery was lifted from its foundations and moved into the snow, into empty corners of buildings, anywhere, to make way for the armament program. The dismantling process swept everything before it – conveyors, special machinery, equipment of all descriptions which made automobile manufacturers famous for the efficiency of their methods and for their ability to produce and sell cars at a price within the range of tens of millions of people.

Spearhead in the Battle of Production

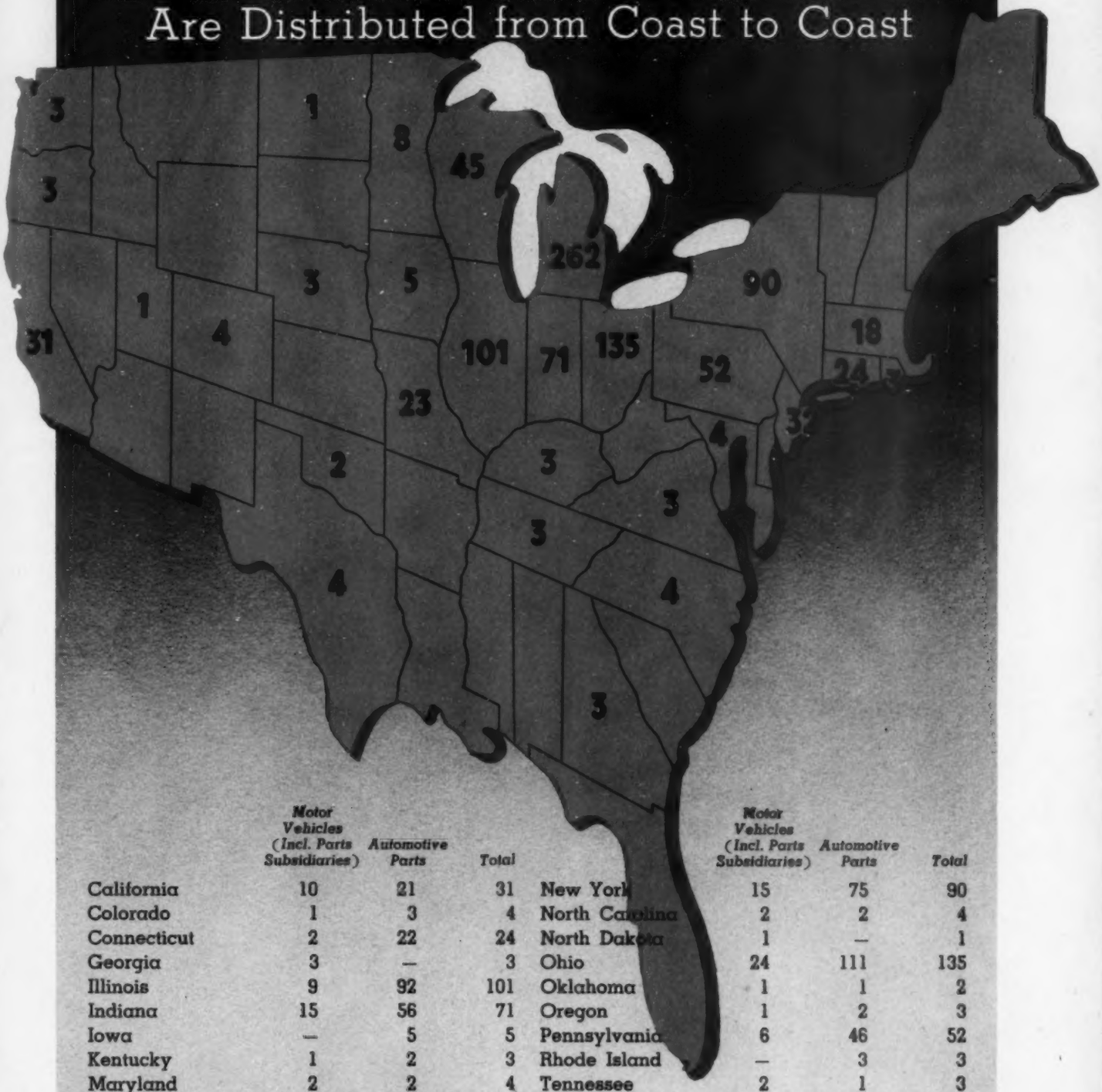
Detroit has turned its house upside down to go to work for Uncle Sam. The automobile industry, far more than any other industry, has been chosen as the spearhead in the Battle of Production against the Axis and its allies.

Why? The answer is easy. Automobile makers operate the world's largest machine shop. By applying their own manufacturing technique, which proved so effective in peacetime, they will produce more munitions by far than any other industry anywhere.

A tall statement, yes. But remember that within automotive ranks is concentrated the greatest array of managerial and engineering talent, of labor supply and of the "know-how" of mass production to be found in the world.

It is no news to Uncle Sam, though it may be to John Q. Public,

Automotive Plants Making War Products Are Distributed from Coast to Coast



	Motor Vehicles (Incl. Parts Subsidiaries)	Automotive Parts	Total		Motor Vehicles (Incl. Parts Subsidiaries)	Automotive Parts	Total
California	10	21	31	New York	15	75	90
Colorado	1	3	4	North Carolina	2	2	4
Connecticut	2	22	24	North Dakota	1	—	1
Georgia	3	—	3	Ohio	24	111	135
Illinois	9	92	101	Oklahoma	1	1	2
Indiana	15	56	71	Oregon	1	2	3
Iowa	—	5	5	Pennsylvania	6	46	52
Kentucky	1	2	3	Rhode Island	—	3	3
Maryland	2	2	4	Tennessee	2	1	3
Massachusetts	1	17	18	Texas	2	2	4
Michigan	63	199	262	Utah	1	—	1
Minnesota	1	7	8	Virginia	2	1	3
Missouri	8	15	23	Washington	2	1	3
Nebraska	1	2	3	Wisconsin	9	36	45
New Jersey	9	23	32	Total	194	747	941

WAR PRODUCTS MADE BY AUTOMOTIVE COMPANIES

Airplanes
Aircraft engines
Landing gear assemblies
Propellers
Aircraft engine bearings
Bomb release solenoids
Gun synchronizers
Bomber subassemblies
Aircraft cannon
Aircraft machine guns
Instrument panels
Aluminum forgings
Automatic pilots

that over one-seventh of all the metal-working equipment in the United States is in automobile factories. General Motors alone, in normal times, produces eight percent of the country's durable goods and 12 percent of all fabricated metal products.

No wonder Secretary of the Navy Frank Knox said, "Detroit is the most important place in our production areas. Almost everything that we are short of and need, Detroit makes."

Automotive Plants in Almost Every State

When Mr. Knox speaks of Detroit, he means the automobile industry. Like most people, he probably thinks of the two in the same breath. Detroit is the world's biggest center of mass production. It is the nerve center of the motor car industry. But, in reality, automobile manufacturing is a far-flung operation extending from the Atlantic to the Pacific and particularly well distributed over that portion of the United States east of the Mississippi and north of the Ohio.

It spreads over many states and into scores of communities. It is fed parts by an automotive parts industry, which itself is no pigmy. Parts makers dot the landscape of most of our 48 states. In addition, materials come from almost everywhere. The parts and materials suppliers of any of the big automobile companies are numbered in the thousands.

What kind of a load is Uncle Sam, locked in a fight for freedom, putting on this behemoth of industries? In the answer to this question is to be found the proof of Uncle Sam's belief in the extraordinary productive powers of this industry.

The war-order load, in terms of sales dollar volume, amounts to fourteen billion dollars a year. It involves almost every conceivable kind of war product from tiny powder metal bearings to ponderous tanks and four-engined bombing planes.

By comparison, 1937 automobile output, highest on record in peacetime, was valued at five billion dollars.

Bear in mind that the industry in its best years never turned out many more than five million passenger cars and trucks. Yet the flow of materials for war production through the automobile industry will be the equivalent of making fifteen million automobiles a year.

When running at full capacity on war orders now on hand, three of the biggest automobile companies will be producing at two and a half times the dollar volume they did in their peak month of 1941.

Translated into manpower, the war demand will be unprecedented. In its palmiest peacetime days the industry never employed over 562,000 men. When it attains maximum war operations, it will have on its payrolls close to one million men and women.

In the lap of this industry has been reposed the job of making a large portion of the tanks and bombing planes and anti-aircraft guns and airplane engines needed by our armed services, not to mention hundreds of other items. And on top of that assignment is the task of

motorizing an army which, until a short time ago, was neither motorized nor mechanized.

Unfortunately for us all, you can't have automobiles coming off an assembly line one day and tanks the next. Nor will tanks roll off the line the next week or the next month. As "Boss" Kettering remarked, "Guns are not windshield wipers." You don't make them the same way. Before the automobile industry could go "all-out" for Uncle Sam, it had to pass through the painful process of converting its plant facilities.

What does conversion mean? It sounds mysterious, but isn't. Automobile people have been accustomed for years to conversion under another and simpler name. They refer to this preparatory process as "tooling up." Tooling up is part of their language and of their experience.

They have tooled up yearly when they changed from one passenger car model to another. Tooling up is complicated and full of headaches, even in peacetime where the product – automobiles – remains the same, though design and production alterations are made. The complications and headaches increase geometrically when the change entails such a radical shift as from motor cars to munitions.

To be specific, take Chrysler. Its changeover involves planning and supervision by 50 manufacturing executives and plant managers; 500 master mechanics and tool and die engineers; 3,000 superintendents, foremen and assistant foremen; and 1,300 engineers, laboratory technicians, designers and craftsmen. These are the key men of the company's working force.

Every Job Must Be "Broken into Pieces"

These men break down into pieces what is to be done. Production lines then are rearranged; tools, dies, jigs and fixtures are built. As many existing machines as possible are adapted to new operations. New machines, often specially designed for specific jobs, are ordered and installed.

When these things are done, some trial pieces are made and the pieces put together to see that they fit properly (because success of mass production depends upon interchangeability of standardized parts fabricated by the thousands).

This preliminary work with so-called "pilot models" is largely done by hand. After the quality and accuracy of the first pieces are determined by rigid inspection, the volume begins to come as added machinery is installed. This long and laborious process must be gone through, whether automobiles or guns are wanted. It is a time-consuming procedure.

This sketchy outline of the tooling up procedure hardly gives an adequate conception of the intricacies involved. It skips over completely such vital matters as studying the blueprints of the job; making the drawings for new tools; erecting new buildings and remodeling old ones; obtaining prices of parts and raw materials from outside sources and

WAR PRODUCTS MADE BY AUTOMOTIVE COMPANIES

Tanks
Armored cars
Tank engines
Tank gun mounts
Tank tracks
Tank cannon
Steel castings
Fuel pump motors
Steel forgings
Spark plugs
Control wheels
Radiators
Transmissions

arranging for their flow into the plants at the right time in the right volume; determining what parts can best be made by what subcontractors; and taking care of the many design changes in the war product as they come through.

What Uncle Sam asked, more than anything else, of the automotive industry was speed in getting going. Time was short. Nineteen forty-two would be the crucial year in the war. So the automobile and allied industries banded themselves together and formed the Automotive Council for War Production. This council is comprised of passenger car, truck, bus, trailer, body, parts, accessories and tool and die manufacturers.

Through its machine tool listing service, this council is listing machines not being used in war production by individual participating companies for the war service of other companies. Many transfers of equipment thus are being made. These transfers normally are on a purchase or lease basis, though some "loans" of machinery have been arranged.

Licking the Problems of Time and Equipment

Of the first 102,000 pieces of listed equipment to be classified, nearly two-thirds already are producing war materials or are earmarked for that purpose. Ultimately some 250,000 tools will be listed.

Surplus facilities for making gages, cutting tools, jigs, fixtures and sheet metal and forging dies are posted with the council by the automotive tool companies so that automobile makers can learn quickly which firms have capacity available for specific tooling jobs.

Most important of all, the council provides cooperative assistance for participating companies to increase the quantity and quality of the war output through its military vehicles service, its war products divisions and the Society of Automotive Engineers War Engineering Board. The interchange of engineering and production information by companies working on similar war tasks contributes to the common goal and is, in effect, a wartime pooling of the automotive industry's "know-how."

In the desire for speedy results, automobile manufacturers wanted to get into production of war goods with a minimum of delay. Instead of waiting for months for new equipment, they are making use of their former automotive machine tools wherever possible.

Chrysler, for example, has already converted or is converting to specific war jobs 78 percent of all of its machine tools. More than 60 percent of the machines required to handle the corporation's war orders (the number of machines being much larger than for motor car output) will be retooled automotive equipment, taken from Chrysler's own plants.

Every nook and corner of automobile factories has been searched for equipment suitable to make munitions. Though tools might be 20 years old, age was no bar to service provided that they could be rigged up to do a satisfactory job. Rebuilding of machines often could be done in a fraction of the time needed to get new machines from overburdened machine tool builders.

Changing from Motor Cars to Munitions Is a Long and Involved Process

1 Company bids on specific order for war goods (cannon, for example).

2 Management studies cannon to determine company's ability to produce satisfactorily.

3 Government awards provisional contract; management studies sample cannon or blueprints, determines quantity needed and delivery dates.

4 Engineers "break the job into pieces", decide best method of making each piece, determine kinds and numbers of machines, tools, and other equipment needed (existing equipment to be used where feasible, new equipment bought where necessary).

5 Designers draw plans for tools, jigs, fixtures. Die makers start making actual tools.

6 Purchasing agents get prices on parts and raw materials, check subcontracting possibilities with master mechanics. Accountants study costs.

7 Government and company sign final contract. Company places orders for new machines and equipment, acquires or constructs new plant capacity where needed.

8 Production engineers set up pilot line – one machine of each kind – to produce first few cannon for testing (method similar to that used in automobile manufacture).

9 Company puts nucleus crew of supervisors and mechanics through special training courses to acquaint them with cannon manufacturing processes.

10 Subcontractors start producing. Materials flow into main plant. Pilot line begins operating.

11 Government inspectors put first cannon produced through rigorous service tests, give final okay for the start of mass production. More and more machines and other plant equipment arrive and are installed. Company tests, hires, trains and puts to work more and more workers.

12 Company ships cannon to points designated by government, often ahead of schedule.

13 Almost continuously throughout all these steps, changes are being made in design of the cannon, size of the order, delivery dates. New and better ways of doing the job are devised and adopted.

WAR PRODUCTS MADE BY AUTOMOTIVE COMPANIES

Trucks
Cargo trucks
Truck diesels
Special service trucks
Ambulances
Earth borer trucks
Axle sets
Army staff cars
Reconnaissance cars

Two cases illustrate the point. Before the days of gearshifts on the steering columns of automobiles, an automobile forge plant used a big machine with rolls on it like a clothes wringer to produce long gearshift levers from bars of hot steel. With the coming of new shifts, the old machine outlived its usefulness. It was shipped to the "graveyard."

Meanwhile the company's new aluminum-alloy hammer shop got into production. Raw aluminum stock comes in round bars in standard sizes, often far from the sizes required. Before the hammer men could begin to shape parts, they had to work stock bars down to smaller size—a tedious process. The old "clothes wringer" came in handy. A truck rushed it to the machine repair department where it was rebuilt. In a short time it took its place in the new hammer shop and is now rolling down big bars of aluminum for airplane parts.

The other case is that of an automobile company which had the problem of spooning out a hole in a piece of tough steel for an anti-aircraft gun. It was a job for milling machines, but new milling machines could not be obtained quickly for love or money. Forty-four of them were needed.

So the master mechanic made use of his "know-how". He remembered that up in the rear axle department were 44 gear finishers. All were 20 years old or more. He had them stripped down to the base and new hand-made parts provided. When the rebuilding was done, the former gear finishers emerged as milling machines. Nearly 1,000 hours of machine-shop time went into each machine. Yet all of this conversion work resulted in taking care of only one of about 30 operations on just one part.

Many Tools Can't Be Used on Munitions

Much existing automotive equipment cannot be retooled for armament work. It is of a highly specialized, single-purpose type designed and built to do one thing at high speed and in large numbers. Even some of this equipment, however, can be stripped of motors, hydraulic pumps and perhaps jigs and fixtures. It now stands stark and forlorn in the scrap pile, its former power and glory completely gone.

In certain war products, notably airplane engines and tanks, the size of the work is beyond the range of automotive machinery. And the number of operations involved in making an airplane engine crankshaft, for instance, is so much greater than in making an automobile crankshaft that automobile manufacturers would not begin to have enough equipment from automotive operations to do the job. For that reason automobile companies have found it desirable in most cases to equip their aircraft engine plants with brand-new equipment.

Again, keep alive to the fact that making most of the vital war products is not like making automobiles. For one thing, the quantities turned out, even on a mass basis, are so much smaller. Two hundred guns and one hundred tanks might well be the equivalent of 2,000 automobiles

in plant facilities and in manpower absorbed. And the manufacturing tolerances are much closer.

Perhaps ironically, the weapons of war must be made with considerably greater preciseness than most peacetime products, including automobiles. The allowable limits in producing to standards of accuracy are very close, in numerous cases to a ten-thousandth. That necessitates better machining practice, better tooling of machines, closer supervision of the work. All of this has brought new and perplexing problems to the automotive industry.

Up until the time that automobile manufacturers took hold of them, many armament items were made either by hand or on a limited-production basis. If Uncle Sam was to get what he wanted in the time specified, it became essential to convert a hand-made product into a machine-made product. And that involved thousands of hours of the study of parts by men who could look at a hand-made piece and plan the sequence of machines which could whittle each piece out of metal forgings, castings or bar stock.

Supervisors and Workers Trained

Not to be overlooked is the important job of educating supervisors and of training men in the art of making munitions. It was believed at the start of the war production program that three foremen would be needed in armament operations for every one foreman in automobile manufacturing.

Thanks to the well-planned advance training of foremen, they are "learning the ropes" of munitions production in time to do a crack job of breaking in their men and of maintaining high manufacturing standards. One of the largest automobile companies now is of the opinion that the same ratio of foremen will be required for munitions as for motor cars as soon as the "break-in" period is over.

Upon one point you can be sure: the first thing that the automobile people are doing in achieving the production goal named by Uncle Sam is to shatter traditions that long have surrounded armament making.

They are looking critically and searchingly at a tank or a gun as they used to look at an automobile. Wherever possible they are setting up manufacturing patterned after automotive practices. They are ready to try new and daring methods and will succeed. They have not suddenly lost their ingenuity and cunning and genius for turning out goods at a bewildering pace.

The moving of a bare steel frame onto an assembly line and its emergence 80 minutes later as a complete, shiny new automobile makes the observer rub his eyes in wonderment. He would feel the same amazement were he to pass inside the closely-guarded doors of automotive factories and see tanks or guns or aircraft parts coming off the line.

Just to prove that this is not idle talk, let's saunter through a munitions plant now batting out tanks at a heartening pace. To the

WAR PRODUCTS MADE BY AUTOMOTIVE COMPANIES

Guns

Gun firing solenoids

Anti-aircraft gun mounts

Gun shoulder rests

Gun sights

Anti-aircraft cannon

Fire control equipment

Machine guns

Carbines

visitor everything is moving along like clockwork. Parts flow down a line and become subassemblies; these subassemblies pass on to take their positions as main assemblies. And the various units dovetail into the final big assembly lines, from the end of which ponderous portable forts are driven under their own power out the door to a severe test of their mechanical fitness and durability.

The timing is almost uncanny, just as it is in a factory making motor cars. A thousand processes are made to interlock at every point. Each has its assigned pace and production, each man at his station knows his day's requirements, and the result is a steady, unhurried flow from raw materials to finished product.

The drama of coordinating hundreds of intricate operations is as fascinating as anything you will see on Broadway. Back of each man on the final assembly line is a crew of experts, men who cast and forge steel tank parts, cut the gears, rough-bore the cylinders, match pistons, making

A NEW AND HARDER JOB

It takes 87 machines to make 53

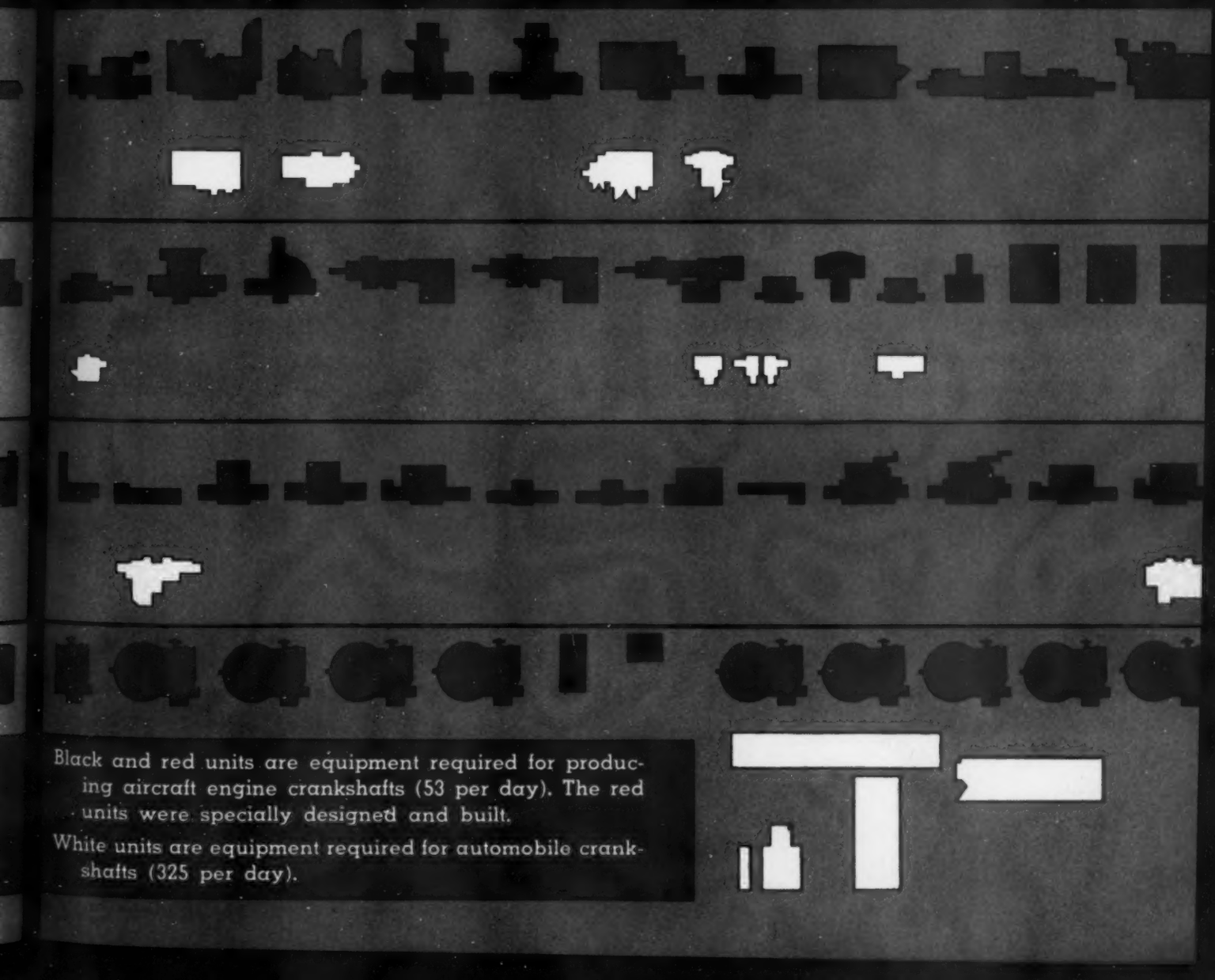
parts with an amazing degree of accuracy, and fitting them to an almost infinitesimal tolerance, each feeding his particular product into the main assembly line at the proper sequence and tempo.

You survey this panorama, catch your breath and say to yourself, "If automotive people can transform a bare country field into this teeming factory in less than a year, I'm glad Uncle Sam has piled such a big job on them!"

This confidence in the ability of automobile people to do a bang-up war job rests on what the industry already has done in adapting its own time-tried methods to the manufacture of guns and tanks and planes. Let's examine snatches of evidence.

When an automobile company last year began to set up for production of anti-aircraft cannon, its experts examined the gun and said, "Isn't it a shame that nobody ever made it so that all parts for any one gun would fit all guns like it?" Foreign manufacturing instructions spe-

53 aircraft engine crankshafts—only 40 machines to make 325 crankshafts for an automobile



Black and red units are equipment required for producing aircraft engine crankshafts (53 per day). The red units were specially designed and built.

White units are equipment required for automobile crankshafts (325 per day).

WAR PRODUCTS MADE BY AUTOMOTIVE COMPANIES

Diesel engines for submarines
Auxiliary diesels for Navy
Gun turret bearings
Marine instruments
Navy warning signals
Marine water coolers
Naval gun housings
Catapult bearings
Instrument bearings
Refrigeration units
Oil coolers
Blowers
Boosters

cified hand filing of small parts to achieve close fits.

The automobile industry long ago abandoned such slow processes. Instead the automotive people ordered the small parts machined to close limits and the sharp edges worn off in tumbling machines, a technique borrowed originally from sewing machine parts makers. Gun parts were made so that they were interchangeable with the same parts of any other gun of the same size and type. That speeded production sharply.

Former practice in making the breech ring of this gun had been to machine a 500-pound piece of steel down slowly to a unit weighing around 100 pounds. Automotive men figured out the successful use of a lighter steel forging which can be machined down to close tolerances in fewer hours, with less scrap and better control of the steel's grain structure.

Better still, the engineers recommended a switch from zinc-aluminum die castings to steel stampings in the production of shell clips. These clips, feeding shell into automatic anti-aircraft guns, ordinarily must be discarded after the first round has been fired. To automobile companies this looked like grave waste of scarce aluminum and zinc. Stamping the clips out of inexpensive sheet steel would save five million pounds of critical materials on the first order alone. That was the way it was done.

Automotive Practices Speed War Production

When it came to establishing mass production of machine guns, old practices fell like ten pins. To cut some parts of the gun's mechanism, gunsmiths traditionally used high-speed steel cutting tools, which had to be sharpened after each operation. Cemented carbide tools were substituted with a substantial saving in time.

Techniques developed in manufacture of automobile valve stems were used in turning out firing pins for guns. Trunnion blocks and side holding plates, formerly drilled separately and then fitted together with assembly, were drilled simultaneously so that no laborious fitting operations were necessary.

Rivets, heretofore made one at a time by turning down bar stock with screw machines, were knocked out at a rate of 180 a minute on a "header" machine. Side plates, which used to be milled singly, were ground out six at a time. In cleaning gun barrels after test firing, automotive tradition busters have employed a trick which telescopes 48 hours of work into less than a minute. Rifling, one of the most delicate machining tasks of all, is now done in one-thirtieth the former time. Unbelievable? Yes, until you actually see it done.

A few months ago machine operators were spending six hours and forty minutes counterboring 280 holes in the crankcase, or main framework, of a huge aircraft engine. The time has been reduced to 65 minutes by application of automotive ingenuity. A short while ago seven machines worked an hour drilling 14 holes into each cylinder of an aircraft engine. Thanks to automotive innovations, the schedule today

is three machines in three minutes. Each exhaust valve for an airplane engine until recently had to be machined more than 30 minutes to be equipped with precision-cut grooves. The automotive time on this job is 36 seconds.

One automobile company has adapted the type of mechanical die used in stamping out automobile bodies to shaping the aluminum parts of plane bodies. Another motor car maker so arranged its operations on aircraft engines that hundreds of mechanical inspections for accuracy, made at recurrent stages of the production process, consume a total of only 35 minutes an engine.

Hours have been reduced to seconds in the chemical cleaning of machine gun barrels by adapting equipment formerly used for cleaning automobile metal grilles preparatory to chromium plating. A standard practice in making automobile gears has been transferred to manufacture of tank sprocket wheels.

One automobile company making aircraft engines worried about the perfection of drilled oil lines the inner surfaces of which are invisible. If flaws were present and remained undetected, they might cause interference with the flow of lubricants or coolants and wreck the engine. The company's engineers suggested the use of the bronchoscope, which was invented several years ago as a surgical tool for inspecting the inside of human lungs. The trial was successful and bronchoscopes now are employed for the inspection of aircraft engine innards.

Tons of Critical Materials Saved

Vital materials which are now scarce have been saved by automobile companies in their war operations. Searchlights to probe the skies for enemy planes are needed by the thousands. They used to be made of aluminum. Automotive engineers redesigned and reengineered the light, replacing aluminum castings with steel stampings. They had to build the tools for the steel stampings, which are large and heavy, but they were able to put to work an 800-ton die press, previously employed in automobile body work, to stamp out some of the units. The result is a saving of 700 pounds of aluminum in each searchlight. The new light weighs less than the old one; and the steel stampings are interchangeable with the aluminum castings so that repairs can be made to any light now in service.

On one company's contracts for combat vehicles, a total of 41,000 pounds of nickel has been saved by using steel-working techniques formerly applied to passenger car manufacture. In the manufacture of anti-aircraft cannon a laboratory trick has saved to date 420,000 pounds of nickel and 257,000 pounds of chromium in the production of one part alone.

This recital of automotive achievements in the production of war goods could continue for pages. To automotive people these individual accomplishments are almost everyday affairs, because similar innovations have been made in motor car practices for years. More and better cars

WAR PRODUCTS MADE BY AUTOMOTIVE COMPANIES

Electrical equipment
Generators and regulators
Signal parts
Magnetos
Ignition cable
Batteries
Radio receivers
Blackout Lamps
Autosyn motors
Lighting plants

at lower cost have taxed the ingenuity of automobile men. More and better guns and planes and tanks challenge that same ingenuity.

The beginning of war production by the automobile industry predated Pearl Harbor by many months. Chrysler began a study of tank manufacture early in the summer of 1940 and signed the contract in August of that year to erect a tank arsenal for Uncle Sam and start the first mass production of tanks anywhere.

General Motors was asked by the government to examine machine gun making back in 1938 and in May, 1940, was awarded a small educational order. The following September it contracted to make a large quantity of machine guns. Ford broke ground for its airplane engine factory in August, 1940; it began work on its mammoth bomber plant in March, 1941. Packard took on its stupendous aircraft engine job in the middle of 1940. Hudson got the "go ahead" for its naval gun arsenal in December, 1940.

Already Far Ahead of Schedule

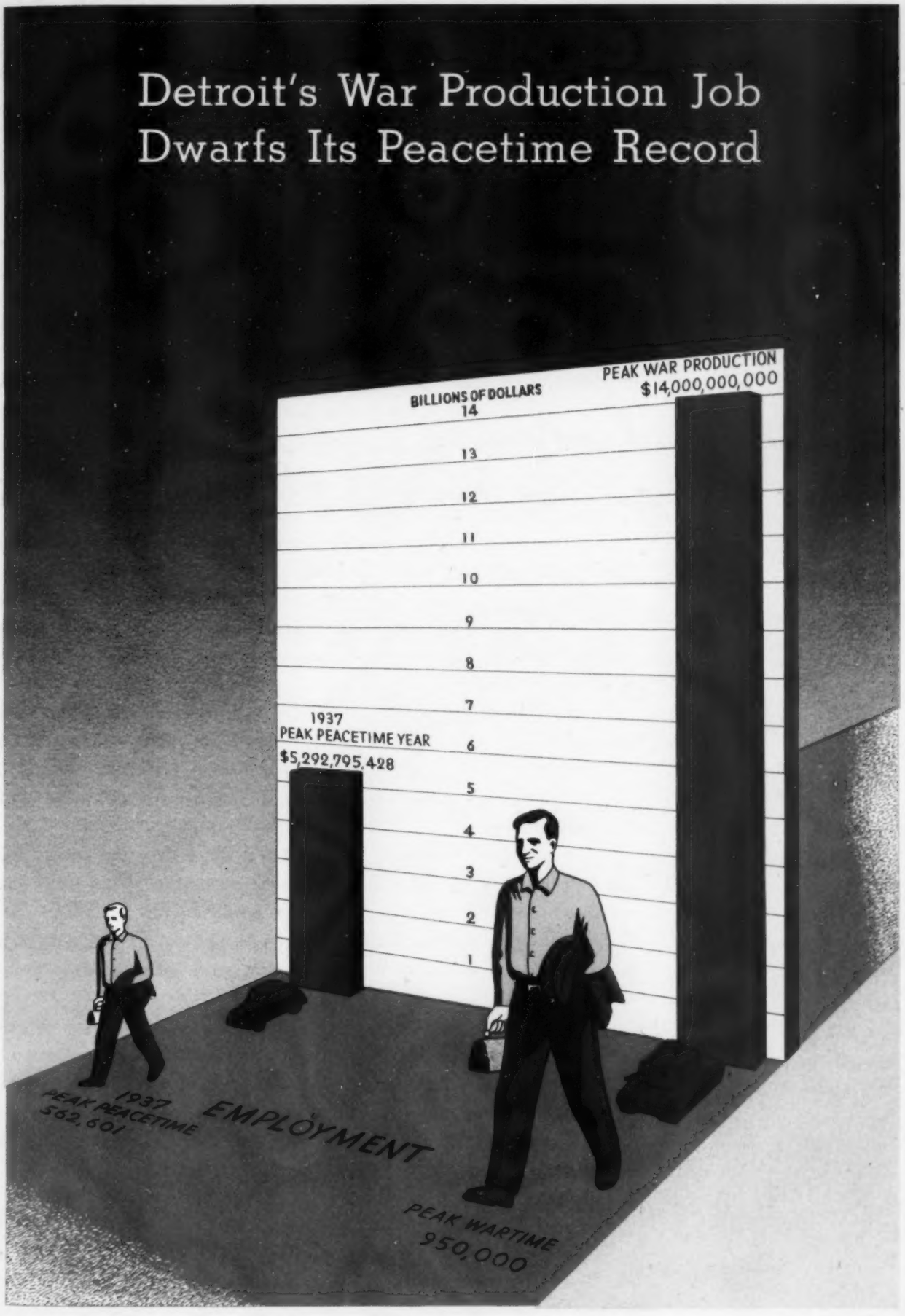
In its time schedule thus far on war products, the automobile industry has been far in advance of the anticipated output. The industry has long ago discarded its automotive lines and in their place munitions are being made in sizeable volume. Even the parts and accessories makers are working full tilt on war orders. "From automotive units to what?" you ask. Well, a spark plug maker is devoting its energies to producing machine guns, a wheel fabricator is making shell, a company formerly turning out bumpers is manufacturing bomb components, a motor gasket company is concentrating on bayonet scabbards, a radiator firm is making steel helmets, a heater manufacturer is making machine gun tripods. And so it goes, through a thousand items essential to the successful prosecution of America's war for freedom.

Nowhere is there greater rivalry in peacetime than among automobile companies competing with each other. They always have taken pride in being ahead of the other fellow, particularly in tooling up and putting new models on the commercial market. Working now for a common cause, the industry is showing even more pride in being ahead of schedule in delivering war materials to Uncle Sam.

Specific evidence? K. T. Keller, president of Chrysler Corporation, said the middle of April, "Having beaten our original tank production task by seven months, we expect to set a new record in changing to a bigger and better tank. Our production of cannon is rapidly increasing. What looked at Christmas time like a big schedule for April was shipped long before the month was out, and we expect to double in May what 60 days ago we thought was a big task."

One automotive company is nine months ahead of its contractual timetable, in production of airplane engines for bombers. By July it will have built more engines than it had originally been asked to manufacture through March, 1943.

Detroit's War Production Job Dwarfs Its Peacetime Record



Mass production of a new type of all-welded tank is under way several months ahead of schedule in another automobile company. Starting in January, this concern completed the first of the new tanks in only 47 days.

Converting two of its automobile plants to machine gun manufacture, still another company delivered the first units and began mass production eight months in advance of schedule.

The list could be lengthened many times, but it would all add up to one conclusion: the automobile industry is beating the schedule set up for it by Uncle Sam. Employment hasn't dipped so severely during the war retooling period as people anticipated. While some of the credit in maintaining forces at a higher rate than expected goes to the substantial volume of car maintenance parts manufactured in the first five months of this year, a generous portion must be allotted to the "drive" and pressure which automobile makers have put on getting into war production quickly.

Hourly, Daily, Weekly the Tide of Production Rises

You must keep in mind, however, the point previously stressed: transformation of an entire industry from manufacture of its normal products to production of complicated, intricate war goods takes time. Especially when the procedure involves new technique, new standards, new facilities and complete retooling of plants and retraining of men, it cannot be carried out in a day, or a week, or a month.

When will the predicted torrential flow of war goods come from the automobile industry? The fact is that the flow today is of impressive proportions. Not a week goes by that new manufacturing facilities do not get into production. Much new capacity is coming in now and will be coming in during the summer.

Censorship forbids statement of the time when the entire automotive industry will be at the peak of war production. It is not breaking any rules, however, to say that the time is not far off. It is not an idle boast to say that the automobile industry, once fully tooled, will amaze the world with the huge volume of war goods being turned out to defeat Germany and Italy and Japan.

If any industry in America deserves the well-worn term of "dynamic" it is the automobile industry. It is red-blooded, tough, hard-hitting, free from inhibitions, makes decisions with hair-trigger rapidity, is the first to pioneer in new techniques, new processes and new materials. It hews close to the line of Henry Ford's maxim, "The only thing that is permanent is change."

In a war against an enemy which has won repeated victories by audacious planning and operation and by blitzkrieg tactics, America is fortunate to have this kind of swashbuckling "promise-keeper" to provide the arms and other fighting equipment for her soldiers and sailors and airmen.

WAR PRODUCTS MADE BY AUTOMOTIVE COMPANIES

Shells

Shot

Fuzes

Cartridge cases

Incendiary bomb noses

Magnesium castings

Helmet liners

Primers

Motor Cars to Munitions — CHRYSLER

Didn't Wait for New Machines; Revamped the Ones They Had

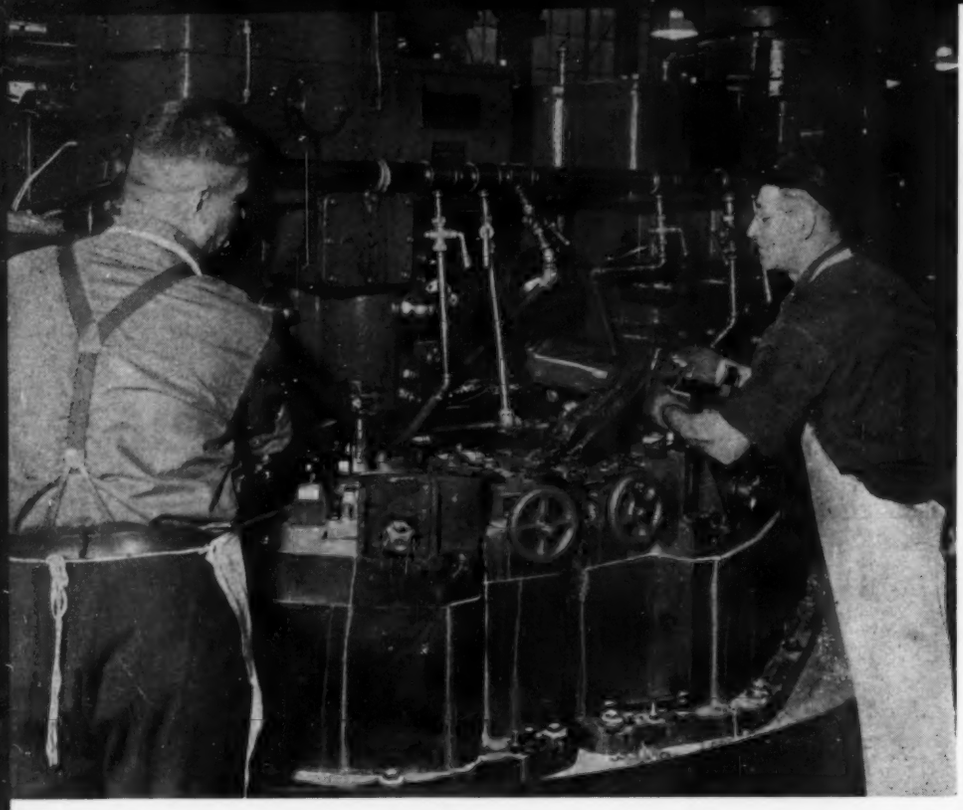
When the new job called for equipment Chrysler didn't have on hand, tool engineers simply remade the old equipment. They even turned drills into lapping machines, a press into a broach, a turret lathe into a boring mill to get production fast

CHRYSLER CORPORATION gained its reputation as a manufacturer of passenger cars; but as the company grew its products became more diversified. It entered successfully into the fields of truck, marine, industrial engine, air conditioning and powdered-metal products manufacture.

In these lines of enterprise, Chrysler built up an organization of more than 80,000 employees with a yearly payroll of about 100 million dollars. It had 19 manufacturing plants in the United States, centered chiefly in the Detroit area but with important units in many other communities in other states; the total floor area exceeded 20 million square feet.

Nearly 20,000 machines were used in the corporation's widespread manufacturing activities. These included 2,200 lathes and boring machines, 3,200 drilling machines, 2,200 grinding machines, 800 gear cutting and finishing machines, 1,100 milling machines, 200

Hundreds of machine tools have been withdrawn from Chrysler's auto-parts production lines and rebuilt for work on war products. In many cases capacity has been increased and braces or stiffening rods added to make the converted machines suitable for their new jobs



Rotary milling machines formerly usel for cylinder block operations have been retooled for machining side frames for the loading mechanism, and for work on tank brackets

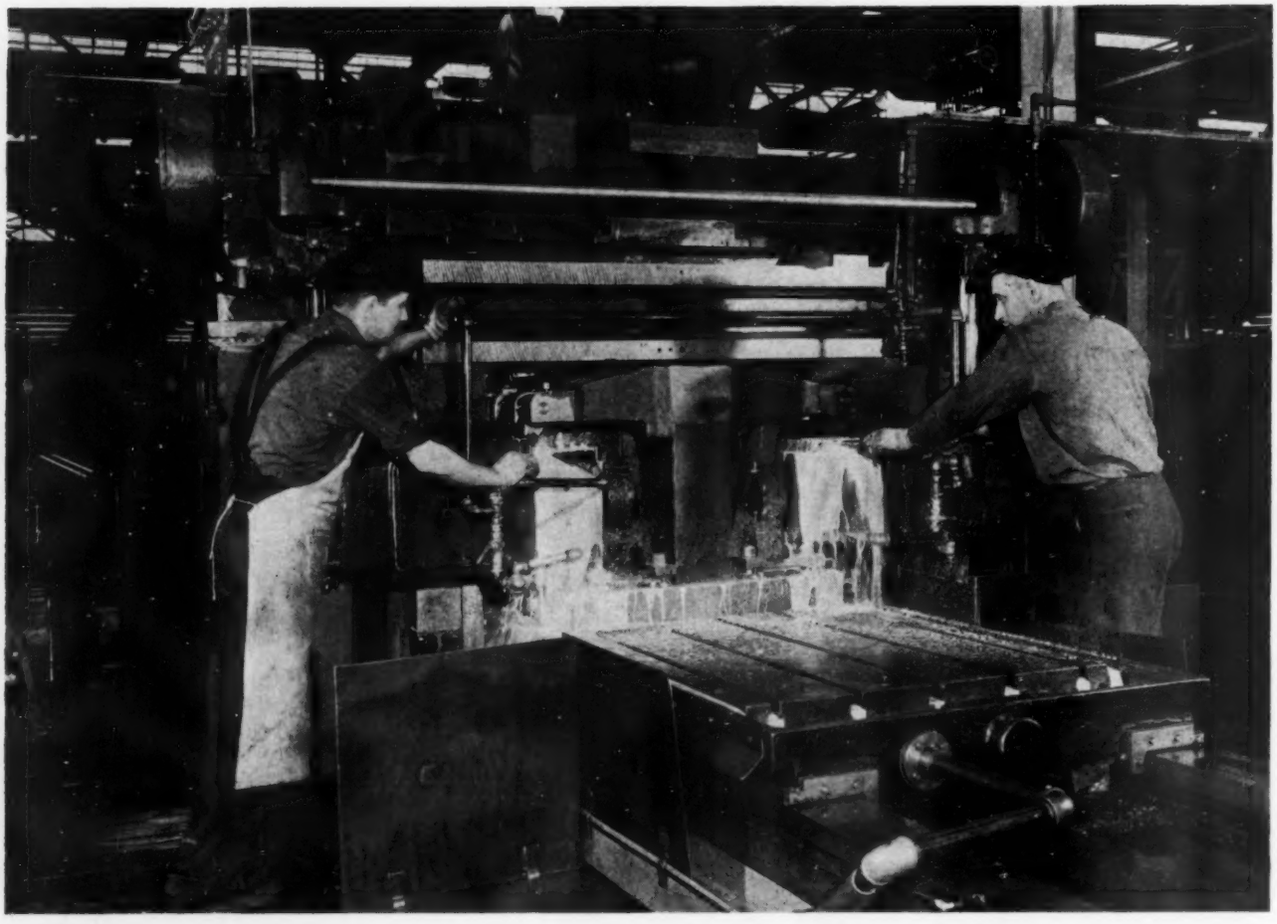
sawing machines, 2,400 presses and other cold-forming machines, and many miscellaneous and specialized pieces of manufacturing equipment.

Chrysler first lent its facilities to the nation's war effort in a field akin to its former activities by supplying military trucks to the Army. Deliveries of these vehicles run into six figures.

In cooperation with the U. S. Army, Chrysler engineers then developed an entirely new type of military vehicle, a ¾-ton truck with four-wheel drive adaptable to a wide range of scout, supply and reconnaissance purposes. Facilities are now being set up for a more powerful type of military vehicle of similar design.

Long before the entry of the United States into the war, Chrysler initiated the construction and operation of its Tank Arsenal previously described in these pages (*AM*—Vol. 85, page 1267). This manufacturing unit employs a unique application of automotive production methods to a modern weapon of war. The Tank Arsenal was

New heads were mounted on this 48-in. planer-type miller so four cutters could be used simultaneously. Two rows of cast steel volute suspension brackets are machined at one pass



originally set up to manufacture a large number of parts and to assemble them on progressive lines; in addition, Chrysler depended on subcontractors for hundreds of tank parts, buying them originally from 700 companies located in 120 cities.

Since the Tank Arsenal was completed, according to original plans, Chrysler Corporation has increased its production greatly by means of an expansion program amounting to many millions. Its operations have been switched over to an advanced design of medium tank. A good part of the increased production has been obtained by adding more tank assembly lines. To make room for these expanded assembly facilities, an addition to the plant will provide more floor space. Many of the parts originally made in the Arsenal have been assigned to Chrysler's automobile factories now converted to war uses. Today six of the corporation's plants are supplying the Arsenal with tank parts. Chrysler has already delivered to the U. S. Army more than twice the number of tanks originally scheduled up to the end of 1942.

With the entry of the United States into the war, Chrysler's conversion to military products was greatly accelerated. Today the corporation is working at no less than 23 major war products.

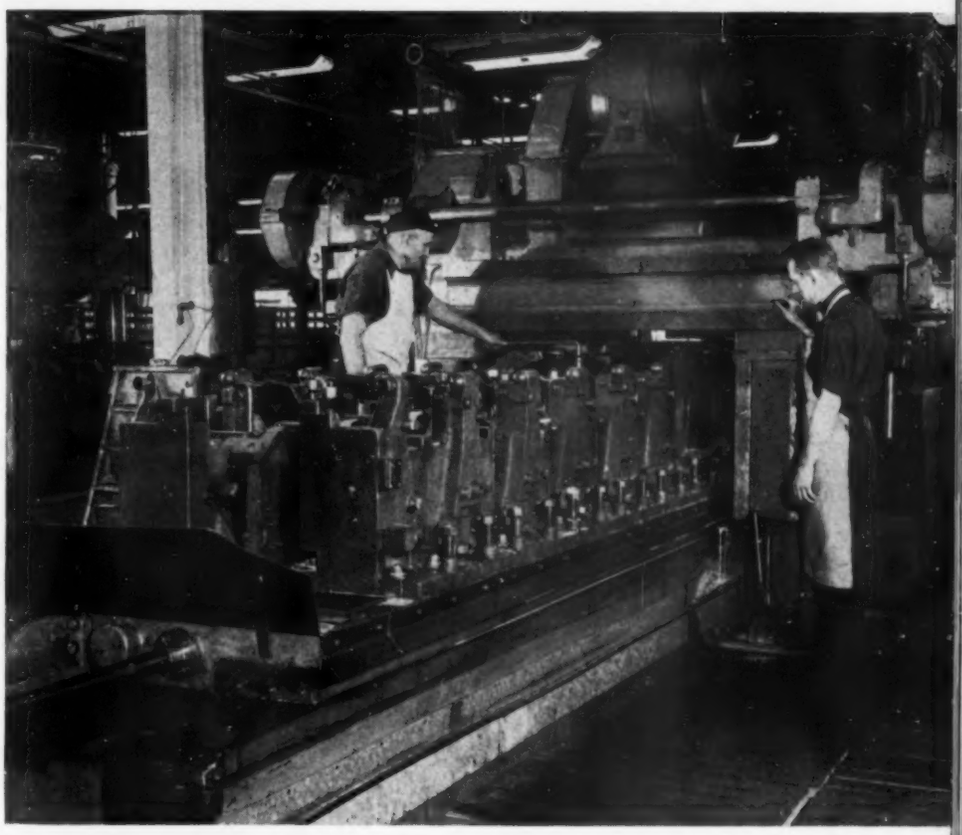
One other entirely new plant, in addition to the Tank Arsenal, is being constructed for the manufacture of aircraft engines.

Existing facilities have been converted to the manufacture of fuselages for bombers and anti-aircraft guns. Both these products have been divided among the corporation's automotive plants so that each manufacturing unit contributes parts and subassemblies.

The final assembly plant for the anti-aircraft gun is also operated by Chrysler Corporation. Schedules on this gun have been increased on two occasions, making the planned output five times that originally contemplated.

Other war products of the Chrysler Corporation are ammunition in various types and sizes, pontoons for the Navy, air raid defense fire fighting equipment, sirens and tank engines. All these war products differ drastically from any of those formerly made by the corporation. They require new techniques, new manufacturing and inspection methods, new arrangements of facilities and new sets of working limits.

The Chrysler organization has been retrained to handle these wartime needs. Machinists have learned to turn out new parts of unfamiliar materials to exacting tolerances. But the process of re-education went much further than this; hundreds of men were taught entirely new trades. For instance, one manufacturing unit was formerly devoted entirely to press work and assembly, and had only a small tool engineering staff. Thus the retooling at that plant was done largely by independent tool engineers.



Special fixtures were developed to hold tank parts on the table of this planer-type miller, which formerly was used to machine engine cylinder blocks

Today, however, members of the corporation's sales force and others have been trained to be tool engineers, and body assemblers have been trained to operate machines. The way in which these individuals have grasped the essentials of their new jobs has proved that they are adaptable to kinds of work they would never have dreamed of tackling under normal conditions.

The change from steel to duralumin for forgings and sheet-metal parts has meant processing a material with entirely different physical characteristics. Hot working temperature ranges are altered; metal flow, hot or cold, for dural is nothing like that of steel. Yet the men in the departments producing stampings and forgings, who learned their trades on steel, have taken hold of the unfamiliar aluminum alloys with a high standard of performance.

As men have been converted to their wartime tasks, so have machines. Existing machinery and conveyor lines have been ripped out wholesale to make room for them. There has been a tremendous job of sorting out old facilities, reassigning machine tools that can be used, rebuilding many of them for new and in many instances more exacting operations, buying both new and used equipment to create a new balance in manufacturing departments.

These many steps have been accomplished speedily but systematically.

Last fall a new complete master inventory was set up by the corporation's staff master mechanic. Each machine was again entered on a master card file giving in detail the manufacturer's name, its capacity, location, serial number, motor information, date of manufacture and former use. From these data lists have been compiled and circulated daily to all production divisions.

In planning their war conversion,

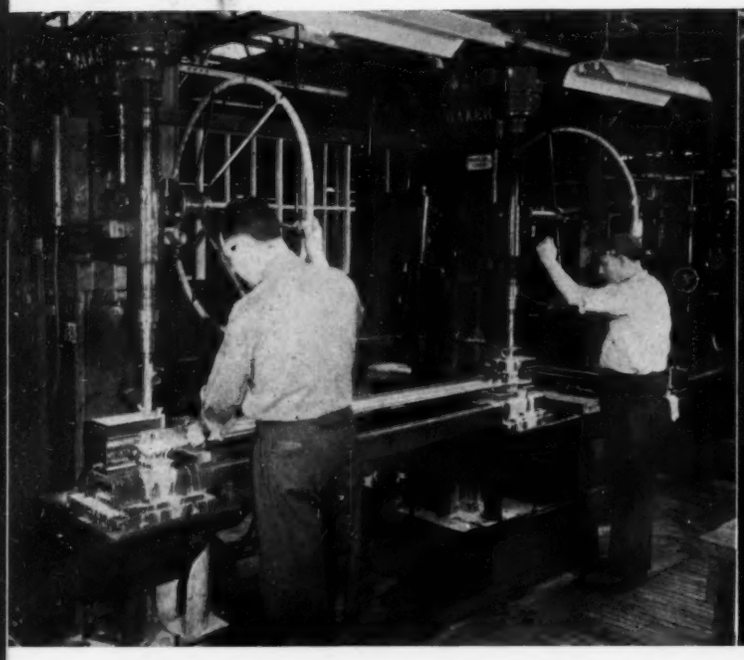
the plant master mechanics and tool engineers have consulted these lists and have drawn on them whenever the existing equipment could be utilized even though it required considerable reconditioning or redesigning. If a listed machine was wanted, the division needing it put in a request, and a notification of change was sent to the staff master mechanic's office. The machine was then taken off the available list, and its record filed under the division to which it was assigned.

purchased. Of course, this rate will fall as available old equipment is exhausted.

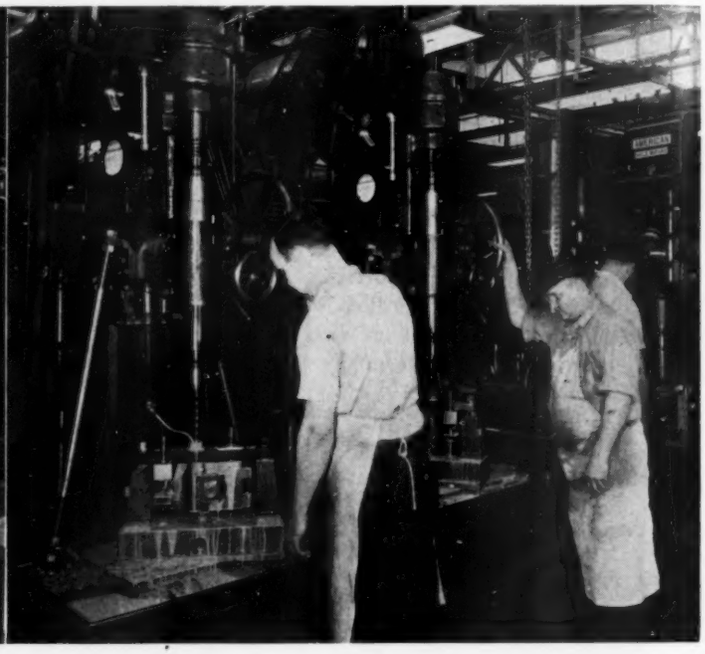
Assignment of equipment was just part of the job. Each piece of machinery had to be fitted into its correct location on a war production line. In many cases, its ways had to be rescraped, its bearings renewed and alignment checked. Frequently the capacity was increased by spacer blocks or by cutting away sections of the machine for additional clearance. Electrical equipment had to be overhauled and in many

the 21 percent of as yet unconverted equipment. There was also an excess of such units as punch presses and resistance welders for which no wartime use has yet been found.

In turn, Chrysler Corporation has scoured the second-hand market in order to buy units that could be rebuilt for its present program with a saving of valuable months of time over the acquisition of new units. Most of the used machines would not have been considered by the corporation in the



Tied together with spacer rods at top and bottom, these two drills now function as a single machine for operations on a forged aluminum spar chord for a bomber. The jig also serves to connect the two machines



These drills needed for operations on the breech block were reinforced by replacing knee-type tables with solid box tables, and by adding tie rods on either side of each column. Deflection under cut was reduced materially

Naturally there were conflicts; sometimes two divisions claimed the same machine the same day. Priority was given to the first request received unless it was shown that a later request was of greater value to the program as a whole.

Machine assignments were charted graphically to trace the progress of conversion. They were also posted on a master index which showed the number of each kind of machine assigned to each war product. More than 79 percent of the corporation's equipment has been so assigned for conversion to war use and the remainder is listed with the Automotive Council for War Production. Two and a half machine tools have been converted for each new one

instances replaced by more powerful units. Rigidity was increased by braces and stiffening rods. Speeds and feeds were stepped up in some cases, reduced in others. All the mechanical ingenuity and experience of Chrysler tool engineers was concentrated on this vast job of conversion.

Of course, not all of the old equipment could be converted. Many of the old automobile and truck operations have no counterpart in the new business of supplying war products. Some of the machines formerly used were highly specialized making it uneconomical and in many cases impossible to adapt them to new uses. Other machines were simply not called for in the new production line-up. These machines fall into

highly competitive field of automotive manufacture where only the best was sought to turn out a quality product at low cost. Now with time the essence of production, every available means is employed to utilize any facilities that will advance the program.

Notwithstanding the widespread conversion of existing equipment and the application of used machines where possible, large sums are being spent on the acquisition of new machine tools. The war products whose manufacture was undertaken by Chrsyler have new characteristics which call for methods differing widely from those formerly used on automobile work.

For one thing the quantities are necessarily limited despite the stepped-up

schedules. There is a big difference in the technique permissible when manufacturing dozens a day instead of thousands.

Consideration must also be given to change of design. The rapid advances in aircraft construction are well known. Already the medium tank originally manufactured by Chrysler has been radically redesigned twice as a result of changes in war technique.

Competition on the battlefield is so intense that it cannot wait for yearly model changes. Improvements that will give our armed forces an advantage must be incorporated into military products as quickly as possible, and with a minimum interruption to production. General purpose machines are used as much as possible because of their adaptability to quick changes in design.

One example will give some indication of the way in which Chrysler's machine tool facilities have been affected by the conversion program. The original inventory of equipment showed 5 percent to be milling machines of both standard and special types. Today milling machines form 37 percent of the total equipment, and most of them are of standard design.

Tank parts in many instances are much larger than anything encountered in the automobile industry. The original tank arsenal was equipped with

Originally used to face cylinder block main bearing caps, this rotary miller was rebuilt to machine bomber quadrants and brake shoes

Needing a special machine to back face bosses in the 40-mm. gun jacket, Chrysler tool engineers dismantled a standard milling machine, turned the housing on its side, and mounted an auxiliary cutter spindle on an extension arm. A pair of cutters now face the bosses in one pass, and a better job is thereby obtained

CHRYSLER

Not having a two spindle machine available for drilling, countersinking and tapping the breech ring, Chrysler tool engineers combined an old drill and a tapper to do the job

This old radial drill now is used for boring a series of circular openings in the tank engine cluster block. The fixture is pivoted so work can be turned

Two single-column drills have been fitted with reciprocating feed mechanisms for lapping valve bodies and disks for a fire trailer pump

An entire battery of gear cutters originally used to cut differential gears for automobiles were rebuilt to machine the curved surfaces on universal joints for four-wheel drive axle shafts

new machines, both large and small, because the government wanted a self-contained medium tank arsenal. But as this operation was broken down and divided among other manufacturing divisions of the company in order to increase production, only the smaller parts could be made on converted equipment.

The anti-aircraft gun calls for new precision requirements that again makes it advisable to use a large percentage of new machine tools. However, completely reconditioned machines find a place in many of the production lines devoted to this product.

Bomber fuselage manufacture presented new problems because of differences in materials, manufacturing limits and size of parts. Here again much of the equipment is new with occasional conversion interspersed where possible.

A look at some examples of converted equipment will give a more concise picture of the manufacturing problems faced by Chrysler tool engineers in getting into war production.

On cylinder block operations for automobile engines a number of planer-type milling machines and center-column rotary milling machines were formerly used. In one of the plants now supplying tank parts, a number of these machines have been converted for various cast steel brackets that were formerly made in the tank arsenal.

For example, a 48-in. milling machine has been put to work on the cast steel volute suspension bracket. Entirely new milling heads have been provided to use four cutters simultaneously. The cutters themselves are new, the largest being 17 in. in diameter. Two sets of holding fixtures have been made to clamp the brackets in place, since this machine is wide enough to accommodate a double row of castings. In addition the feed and speed mechanisms have been entirely rebuilt. Because of the toughness of this material, the feed has been reduced from several inches a minute to $\frac{3}{4}$ in. per min. in order to get economic life out of the cutting tools.

Another planer-type milling machine for the second operation on the same bracket has a special head with a vertical spindle having cutters on upper and lower ends to mill inside pads simultaneously. Here again the feed and speed mechanism had to be entirely rebuilt to meet the requirements of this material.

A similar set-up is found on another planer-type miller which machines the rear idler bracket for the tank. Three cutters are used on an entirely redesigned head, again in conjunction with feed and speed alterations.

A continuous rotary milling machine is now at work on right- and left-hand volute suspension arms. The machine has new cutters, new fixtures, and new feed and speed mechanisms. The feed is now 1 in. per min. reduced from a much higher rate when it was formerly used on cast iron cylinder blocks.

In contrast to this conversion, is the adaptation of several milling machines of the same type for use on side frames for the anti-aircraft gun loading mechanism. Here the problem was not so much a change in speed, as these parts are made of bronze castings. However, the machine had to be torn down completely to obtain the precision required; new cutter heads were supplied

Formerly used on automobile parts, this two-slide broaching machine now machines tank parts

throughout. These machines are well suited for work on these parts, since they mill flat faces and also cut circular grooves for which the rotary table with the new position of the cutters gives the desired radius.

Still another center-column rotary milling machine formerly used on automobile cylinder blocks is now busy on cluster blocks for the new Chrysler tank power unit which uses five automobile engines geared to drive a single shaft. In addition to rearranged heads and rescraped ways, this machine tool has been increased 18 in. in height by means of raising blocks with new vertical shafting to give it added capacity.

A milling machine which in normal times faced cylinder block main bearing caps has been rebuilt to machine bomber quadrants. This machine has a rotary table upon which a special fixture has been mounted for continuous cutting, using three cutters. The fixture also accommodates bomber brake shoes for a similar operation. A horizontal milling machine has been converted from automobile connecting rods to a rough machining operation on the anti-aircraft gun breech block. A face miller, now equipped with new fixtures for military truck parts, formerly turned out clutch housings.

And so conversion has turned a wide variety of types and sizes of milling machines to war work. But probably the prize example for this type of machine tool is an old horizontal milling machine that is now employed on the anti-aircraft gun jacket. This part has a number of holes drilled in either side which have inside bosses that must be faced. When this line was first set up, these bosses were back faced in the radial drilling machine used on the holes. Because of the time taken to insert the back facing tool and the difficulty in gaging the height of the bosses, only seven jackets were completed in 24 hours.

To remedy this condition, the facing

operation was separated from drilling. The upper part of the milling machine housing was cut off just above the normal height of the knee and turned horizontally so the spindle was located over the end of the table and about 18 in. above it. An extension arm was built to hold an auxiliary cutter spindle driven by a length of standard automobile silent chain from the regular spindle. When the work was held horizontally on a fixture, the extension arm extended into the open end of the jacket. A pair of cutters on the auxiliary spindle clean up the inside faces of the bosses in one pass and do a better job than back facing. In addition, each radial drill now takes care of more than three times as many jackets a day.

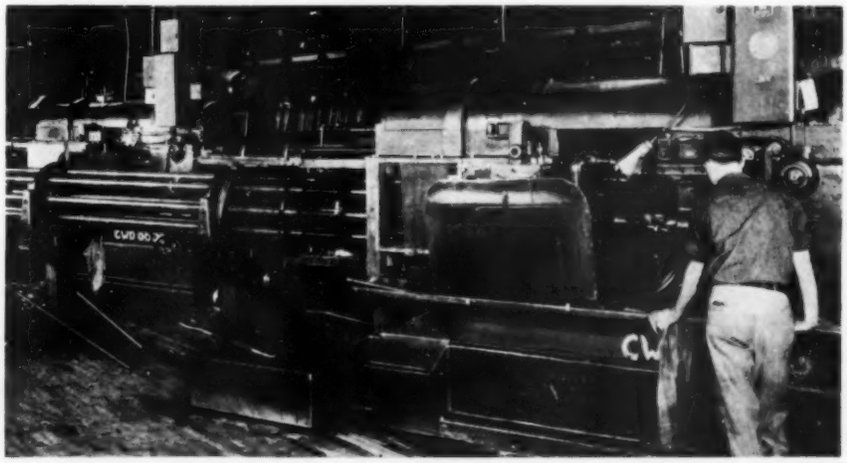
A large number of single-spindle drilling machines of a variety of makes have been changed over to war production. In many cases these have been adopted with little change other than new jigs and fixtures and the right sized tools. In some instances, the machines have been reconditioned or raised on blocks in order to give greater precision or increased capacity.

On a few parts it has been possible to convert some of the multiple-spindle drilling machines. One good example has been the application of a large multiple drilling machine for the cluster block which forms the central member for the new tank power unit. This machine was brought in from one of Chrysler's outlying plants and fitted with new drill heads to meet the new hole centers.

Another machine, a two-way horizontal multiple-spindle drill, has been equipped with new heads to drill the two sides of the base for the gun loading mechanism. Fifteen holes are drilled in each side of the base simultaneously. Similarly a multiple-spindle vertical drilling machine has been adapted for drilling the side frames for this same mechanism by rebuilding the machine and equipping it with new heads.

For machining the spar chord, an aluminum forging used on the bomber, two upright drills have been made into one machine by tying them together with spacer rods at the base and at the top of the columns. The jig which holds the spar chord forms another connecting link between the two machines, and fixes the center distance which must be held accurately within 0.010 in. Another vertical drill is equipped with a special three-way indexing fixture to bore, ream and face three holes in the bomber elbow.

Because of the toughness of heat-treated materials, certain machine tools have had to be reinforced before they could be used on war products. This is true of four vertical drills used on the breech block. These machines have had



A number of automatics have been rebuilt and retooled to make bullet cores. Their present speed is higher than before

Now converted to broach the firing-pin lever slot in the breech block, this hydraulic press was used to straighten rear axle housings in peacetime

An old broaching machine now being used to size the chevron packing on the recoil mechanism originally did service on automobile steering knuckles

the knee-type tables removed and solid box tables made to replace them. Tie rods have been added on either side of each column, connecting it to the table which is securely fastened to the base of the machine. By this means the deflection of the drilling spindles under cut has been reduced to a point consistent with the precision required on the breech-block holes.

Holes are drilled, countersunk and tapped in both sides of the breech ring. Ordinarily such a series of operations calls for a two-spindle machine. Not having such a machine available Chrysler tool engineers made one. An old vertical drilling machine has been tied in with a new tapping machine to give the combination needed.

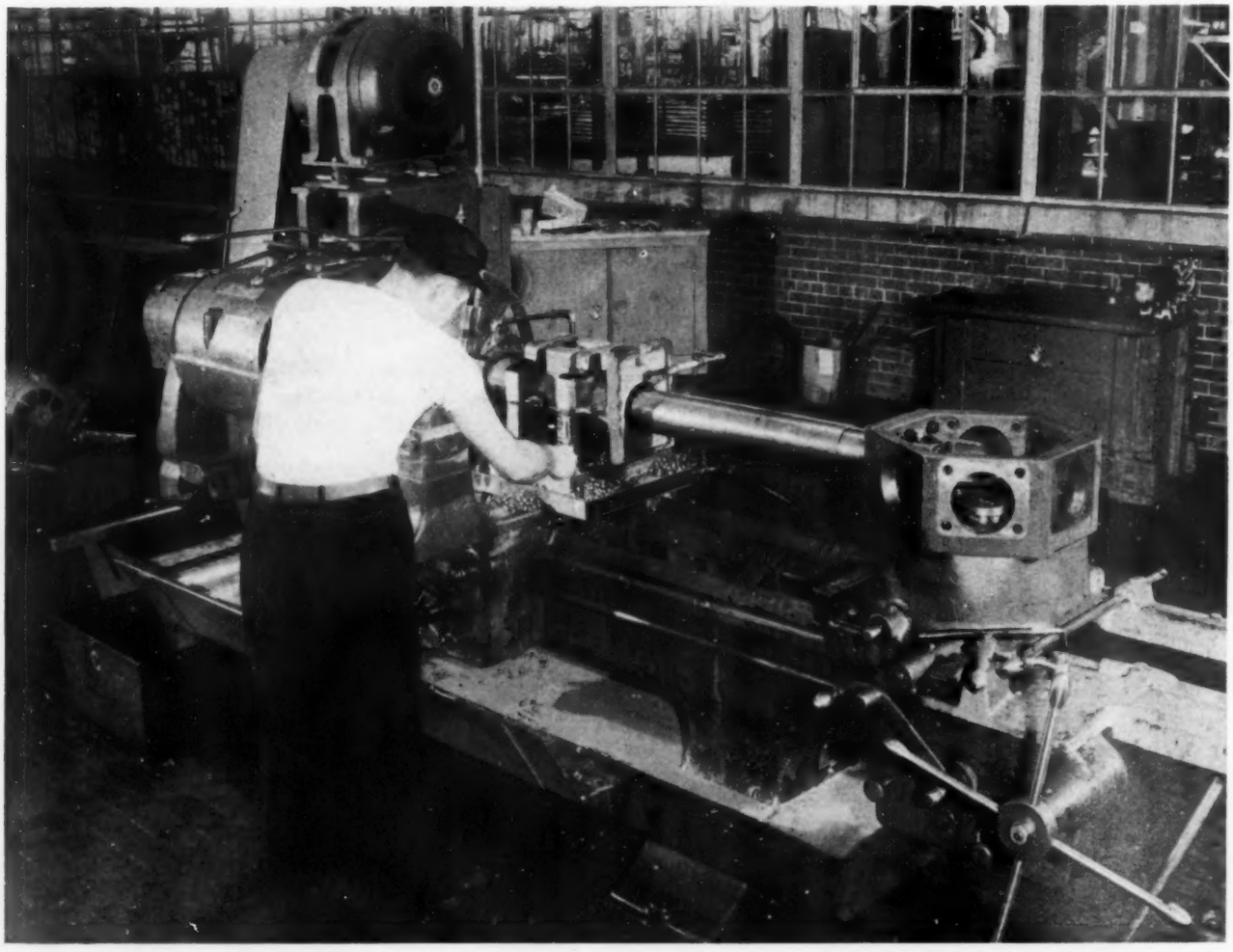
A two-way drill was used in automobile production on the king-pin holes in the steering knuckle. Now the machine is at work on the barrel lock lever hole in the breech ring.

Some drilling machines have been converted to operations other than drilling. For instance, an old radial is used for boring a series of circular openings in the tank engine cluster block. The work is pivoted on a fixture which is so designed that the work can be indexed from hole to hole.

For use on the fire trailer pump a pair of vertical drills have been changed to lapping machines. By providing reciprocating feed mechanisms and substituting laps for twist drills, these two machines now finish the valve body and the pump disk.

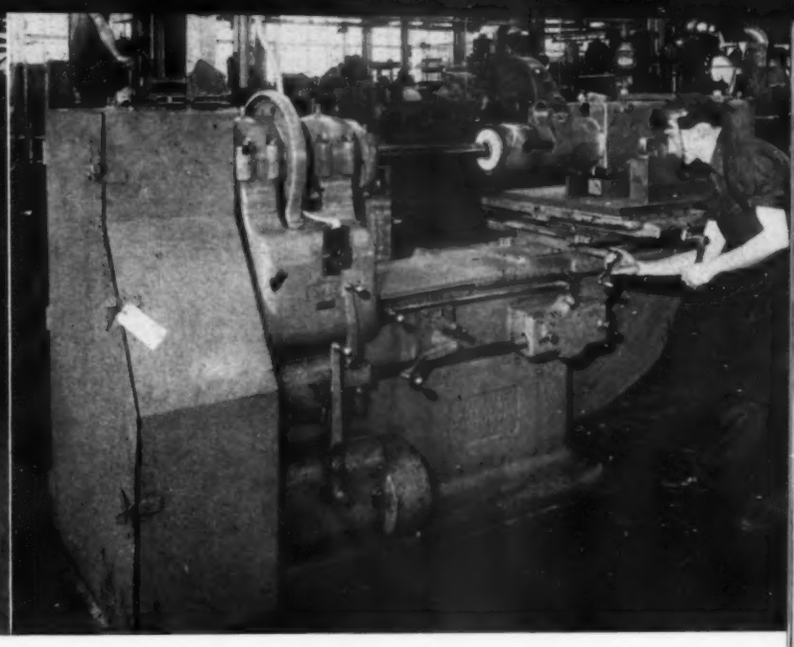
Some gear cutting machines have been adapted to war production with little change other than fixtures and cutters, but frequently more extensive alterations are needed. Tank gears are larger than any used in automotive work and are usually beyond the capacity of old equipment. In the case of a gear shaper, formerly used on transmission gears, the housing has been cut away to provide space for a larger blank and the reciprocating arm lengthened to give increased stroke. The machine is now cutting clutch teeth for the tank cluster drive. A multiple-spindle hobbing machine has been provided with new cams to give the greater length of stroke needed in roughing out tank transmission gears.

For machining the curved surfaces on the universal joints used on the four-wheel drive axle shafts for military vehicles, an entire battery of 44 gear cutters has been rebuilt. These machines were once used on automobile differential gears. Direct motor drives have been substituted for belt drives. The feed and drive mechanisms are entirely new to provide cutting a cycle radically different from that formerly used. The rapid return of the cutter heads has been modified so the machines cut on both arcs of travel, and



A fixture on the cross-slide holds the work and the faceplate drives the boring bar on this turret lathe now used to bore the 40-mm. gun jacket

This internal grinder has been converted to a precision boring machine and is used to finish a tank part. A cemented carbide cutter is used



Fitted with an extended spindle, this internal grinder was purchased second-hand and rebuilt to grind the inside diameter of the forepart of the gun jacket

the spindle has been tilted up to an angle 20-deg. from the horizontal.

Broaching machines are sometimes highly specialized, but even these lend themselves to conversion in some instances. A double-ram broaching machine was used at one time on connecting rods! now it serrates the bores on forged steel levers for the bomber and performs a number of other operations. A vertical broaching machine of ancient vintage, that formerly did service on automobile steering knuckles, is today used to size the chevron packing on the recoil mechanism. Another old broach has been converted to a straightening press and is now busy on the piston rod.

The reverse of this change is found in the same plant. An old hydraulic press that was used to straighten the rear axle housing has been converted to a broaching machine. It is used at present to cut the firing-pin lever slot in the breech block.

Lathes of many types have been put in condition for war jobs. They have been motorized, realigned, provided with new bearings and had their ways rescraped according to the needs of the particular job on which they were to be employed.

Fifty automatic lathes have been entirely rebuilt for use on bullet cores. They have been speeded up, their precision has been restored and the cycles arranged for this new job of mass production.

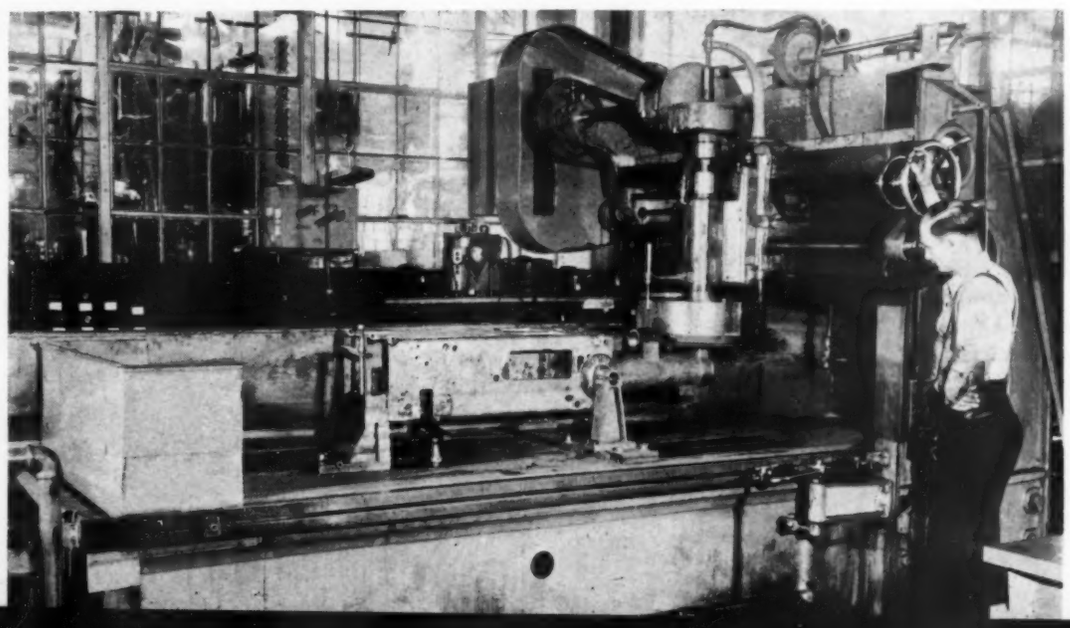
The capacity of an old turret lathe has been increased to accommodate the cluster drive fan. In order to do this, it was necessary to cut away a portion of the bed just ahead of the faceplate, and to turn down the leadscrew to the root diameter of the threads in the corresponding position. Thus a gap lathe was made from a standard machine.

An old turret lathe is being used as a boring mill on the gun jacket. The bar is driven by the faceplate and supported by a bushing mounted in the turret. A special fixture mounted on the cross slide holds the work.

A good example of the conversion of grinding machines is a battery of three centerless grinders now engaged in finishing tank track link pins. These machines are arranged in series so the pins are fed automatically from one machine to the next to take three grinds without intermediate material handling.

An old internal grinder has been equipped with new drive units and the

The special fixture on this planer-type surface grinder permits grinding both sides of the sight feed casting. The machine was resurrected and carefully rebuilt to do accurate work



spindle bearings scraped to restore its accuracy. Formerly used as a cutter grinder in the toolroom, this machine is now capable of the precise job of finishing the firing-pin bushing seat in the breech block. Two other internal grinders, used previously on connecting rods, have been reconditioned and new fixtures added. They are now used on the larger hole in the breech block.

Still another old grinder has been converted to a precision boring machine and is used to finish the inside of the tank cylinder cover. This equipment was purchased second hand. The wheel has been removed and a cemented carbide single-point cutter substituted.

Another second-hand internal grinder that has been put to good use is a 30-year old, single-spindle cylinder grinder, the kind used for regrinding cylinder blocks in garages. An extension has been put on the wheel spindle, including an elongated housing to support the wheel. The machine now grinds the inside diameter of the fore part of the gun jacket.

Many camshaft and crankshaft grinders of a variety of makes are today employed on war products in the Chrysler Corporation plants. As a rule they have been reconditioned and in some cases lengthened to accommodate larger work.

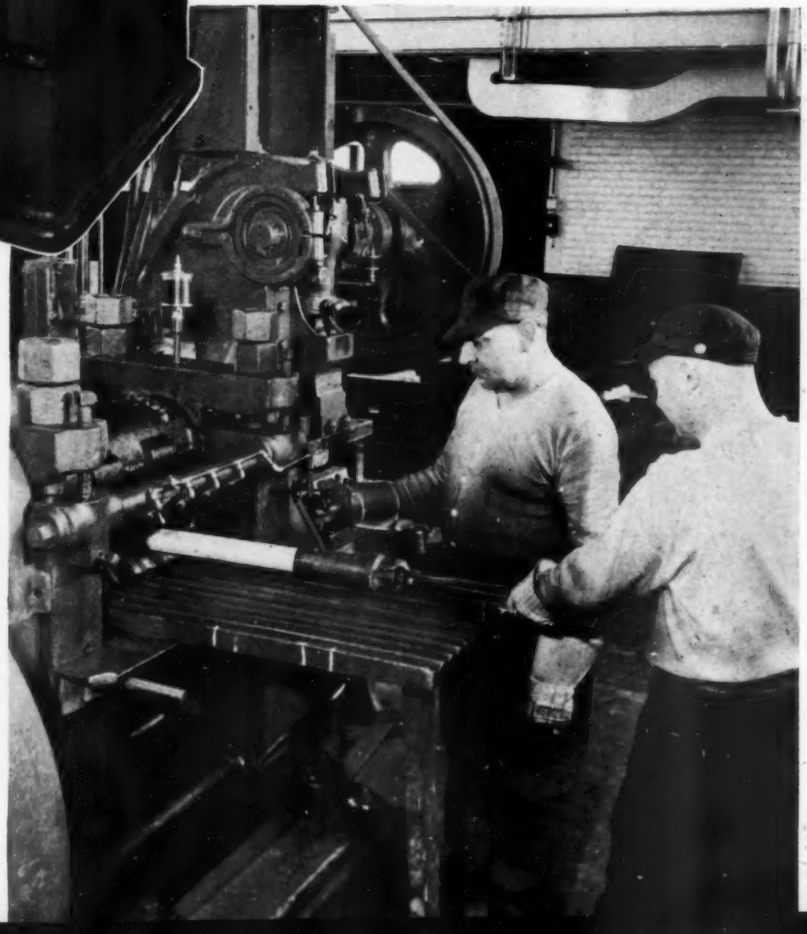
One planer-type grinding machine has been resurrected from the Chrysler morgue and put to work on the sight feed. This part is held on a trunnion fixture, ground first on one side and then on the other. The allowable tolerance is extremely small. The fact that the machine can meet the exacting specifications on the part gives evidence of a thorough job of reconditioning.

The Chrysler forge shop has a pair of power rolls that used to be employed on the job of forming gear shift levers. This machine has been put to use in shaping aluminum bar stock prior to forging. The preliminary rolling process brings the bars closer to the shape of the dies, reduces the amount of hot metal flow required under the hammer and thus produces a better forging in less time.

In the Chrysler Corporation plants can be found instance after instance of machine tool conversion that reflects the ingenuity of the company's tool engineers and the policy of putting all equipment to work wherever possible. The foregoing examples are merely samples of this thoroughgoing program.

To cap the list of conversion and to show just how far the process has been carried, just one more instance will be cited. One of the plants used a pair of

Many camshaft and crankshaft grinders have been pulled out of auto-parts lines and reconditioned for war work. This camshaft grinder now finishes trunnion bearings



This pair of power rolls formerly made gear shift levers—now it shapes aluminum bar stock closer to the die form prior to forging

rotary tables to mount automobile tires on wheel rims. These tables were homemade affairs built by welding structural steel shafts. The wheels were mounted on the tables horizontally and driven by portable pneumatic drills to which they were geared. At first thought these seemed to be devices unpromising to adapt to war work because of their special purpose; but Chrysler tool engineers found a way to use them.

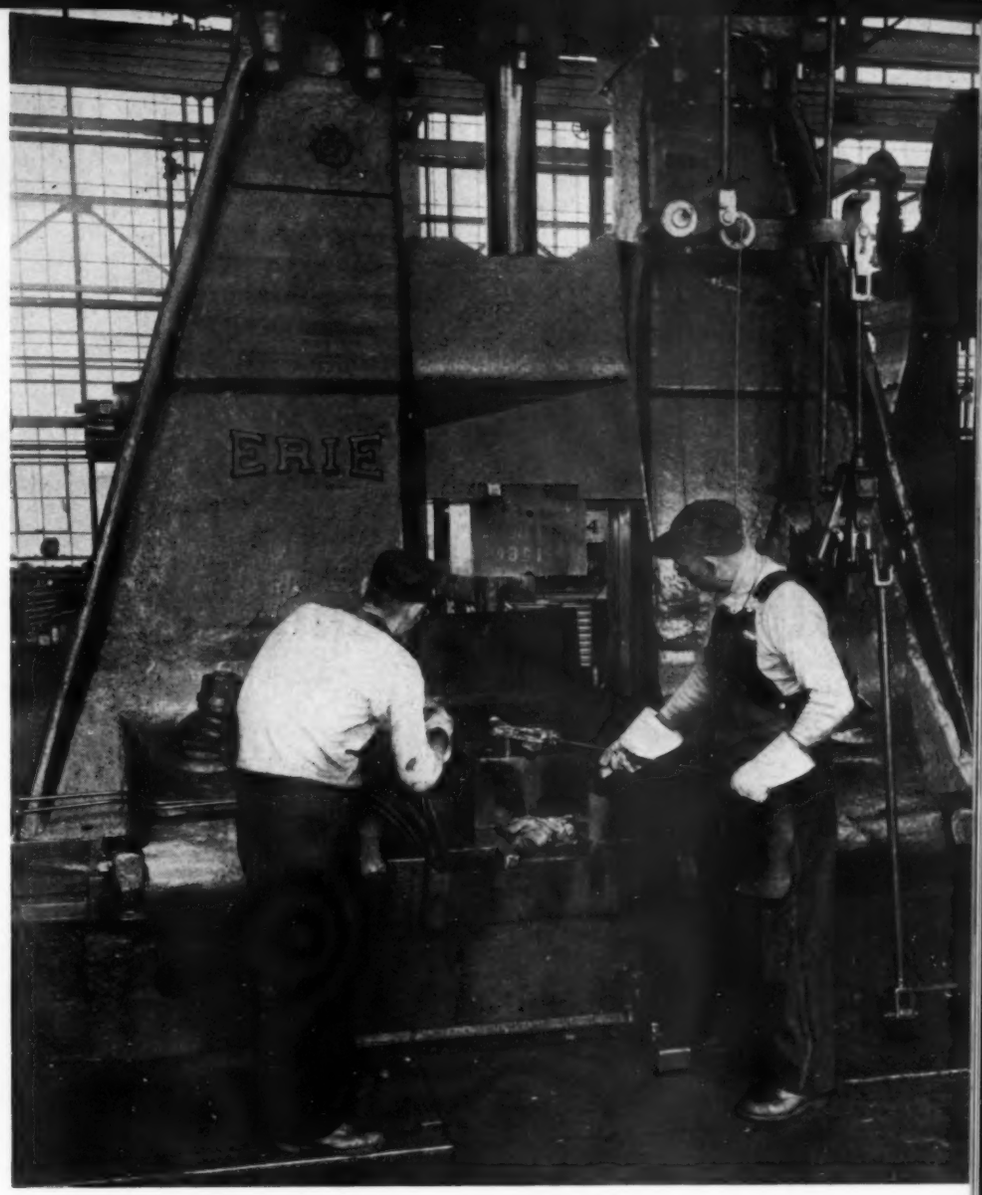
The tables were turned over on their sides, retaining the original frames and driving mechanisms. They are used today for reeling the heavy canvas hose with which the fire engine trailer is equipped. The hose is much too stiff as it comes from the manufacturer to be reeled by hand. Some way had to be found to do it mechanically; the otherwise useless tire-mounting tables filled the bill.

Plant facilities, other than production equipment, can be used for war products when they are of general application. The use of shops trucks, for example has been extended because it is often impossible to store material near the point of use as was done in automobile manufacture.

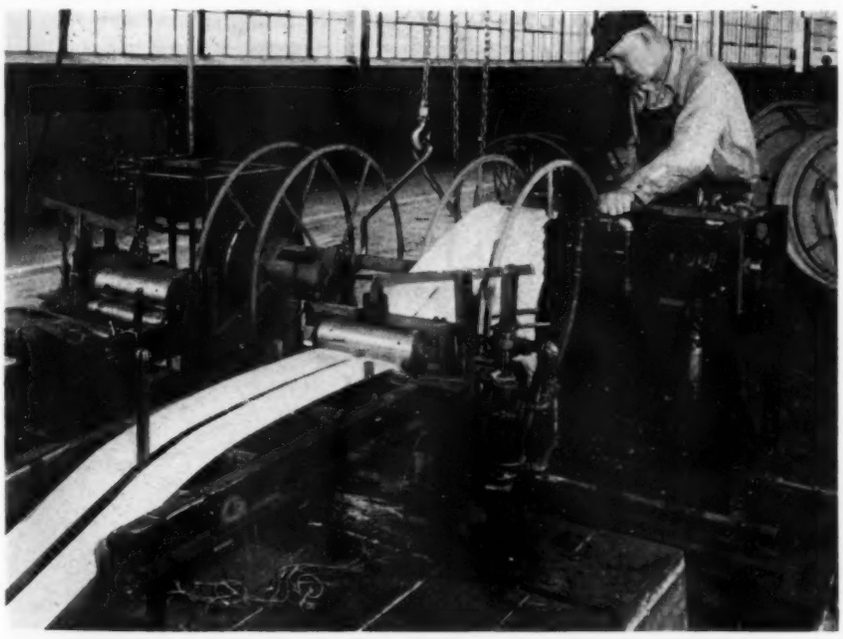
Special conveyors of the overhead or track types have for the most part been discarded. One plant is putting its conveyors into pits in the floor and covering them with floor plates for the duration of the war. Here they are kept out of the way and in good shape.

But even conveyors can sometimes be employed in the current program. The fire engine trailer chassis is now being assembled in the body rework section of one of the body plants. The dollies used to carry the work along the line are still employed. Some welding equipment, formerly used on automobile bodies, is used on the trailer chassis.

The tank turret is being assembled on a conveyorized merry-go-round; this equipment was used for body welding operations before the war. Even the steel from the old body welding fixtures has been utilized in the new set-up.



In the forge shop, the change from steel to duralumin has meant that the hammermen assigned to units forging this material have had to learn a new technique. Their standard of performance has been high



Even the homemade rotary tables developed to mount tires on automobile wheel rims have been converted to war work in one Chrysler plant. Today they are used for reeling hose for fire engine trailers

Motor Cars to Munitions — **FORD**

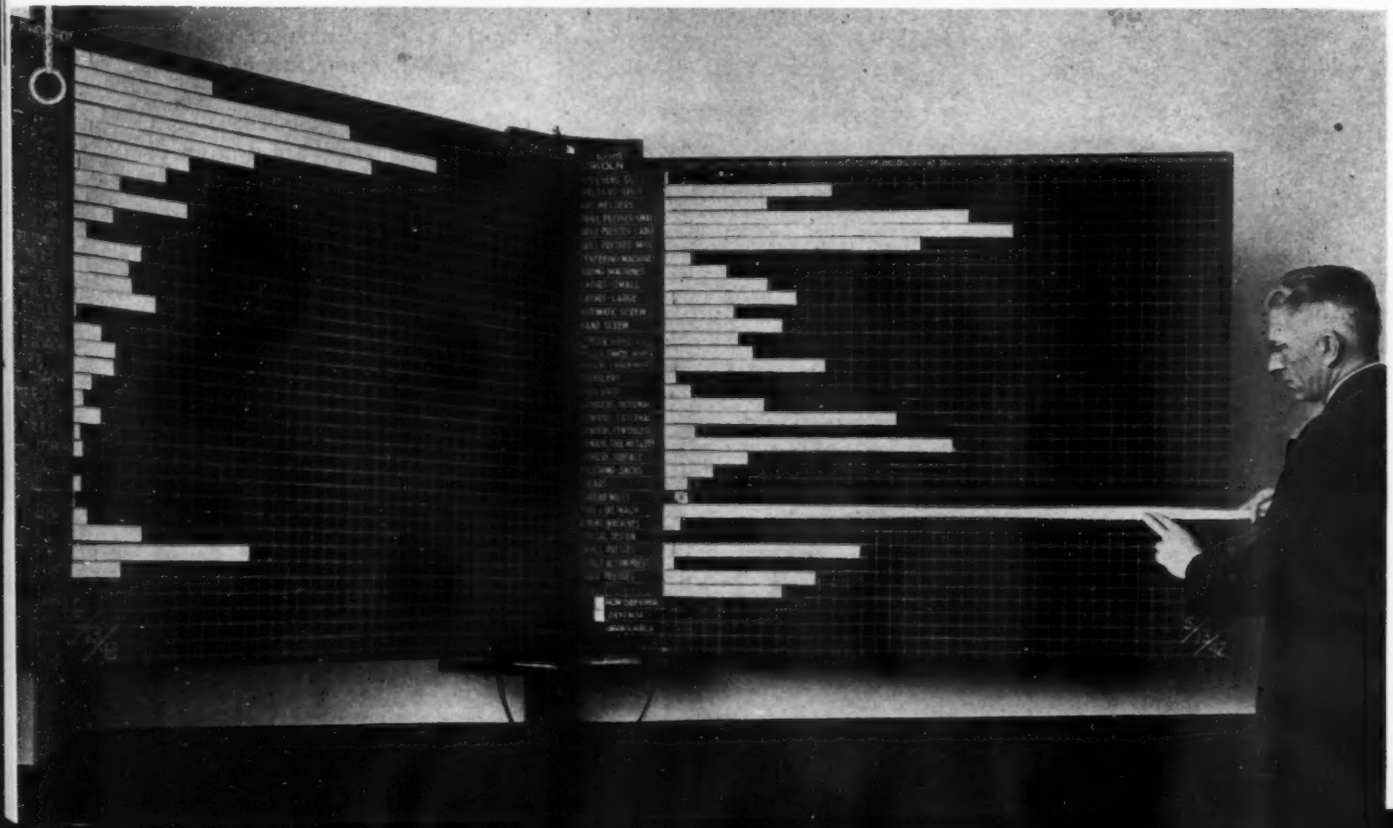
Expands Customary Changeover Methods To Build Many Unfamiliar Products

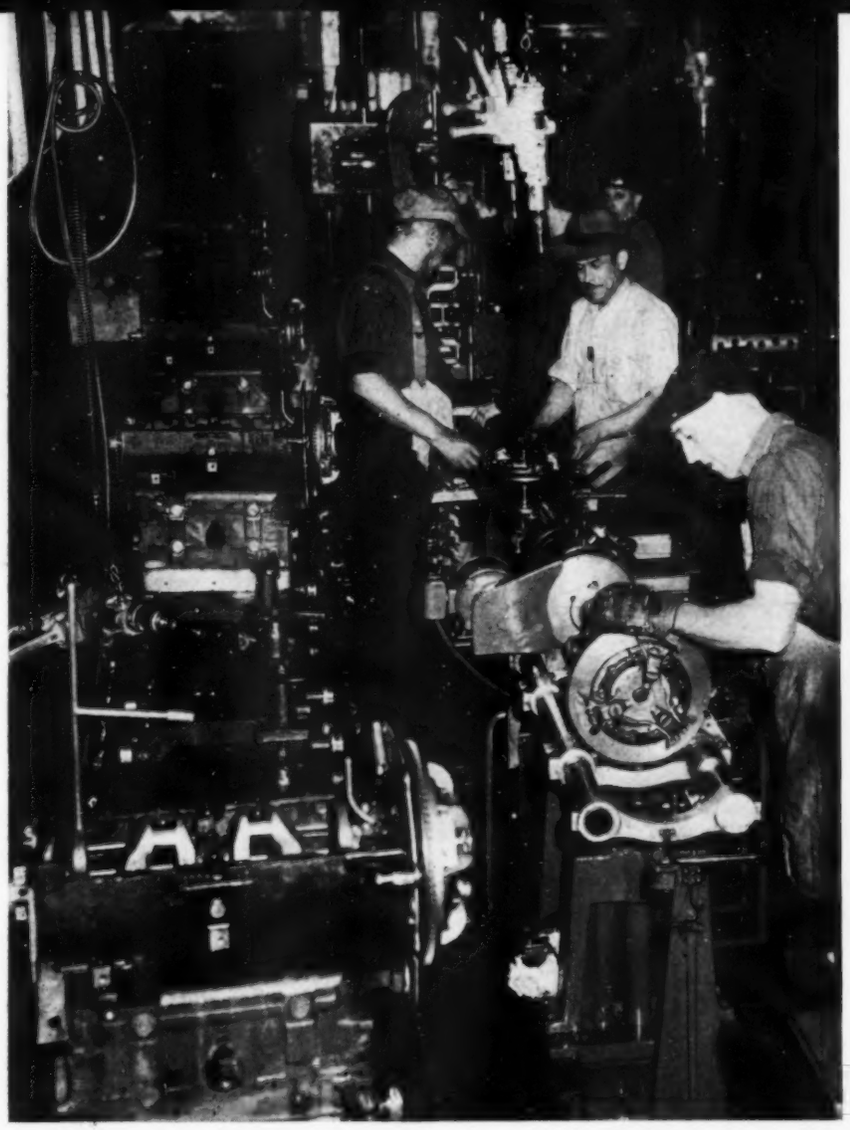
Only one new machine purchased to build high-blocked Jeep motors. Nearly all of Rouge Plant's 200 departments contribute to bomber and tank output

DEFENSE CONTRACTS handled by the Ford Motor Company before Pearl Harbor did not absorb a large share of the production resources associated with the company as a whole—the Rouge, Lincoln and Highland Park plants, the branch plants and the village industries. With the outbreak of war, Ford was called upon for expanded production quotas of bombers and aircraft engines, plus new and important contracts for the more difficult type of materiel—aircraft-engine accessories, tanks, armored vehicles, other ordnance items. Quantities of military trucks and reconnaissance cars were added to the list, but on the whole Ford commitments are foreign to automobile and truck production. When operating at capacity on all contracts, Ford will be producing armament at an annual rate of approximately $1,500,000,000, according to WPB estimates.

Vast changes have been made in the 1,200-acre Rouge Plant, once the mecca of tourists, as well as in other Ford manufacturing properties. Nearly all

Situated in the Superintendent's office at the Rouge Plant, this book-type wall chart gives the war-status of major types of equipment in eleven huge buildings. At mid-May, equipment still operating upon non-defense work or too special-purpose for employment on munitions represented a minor percentage of the total listed





Assembly and balancing of the crankshaft, flywheel and clutch as a unit is done adjacent to the motor assembly line, because production quotas of Jeep motors, at hundreds daily, will not permit some Ford refinements of motor building such as conveyors for feeding parts to the motor assembly line

of the 200 departments at the Rouge are contributing materials or fabricated parts for the two most important assignments—bombers and tanks. The drive to secure machinery and floor space for war production has eliminated auto-plant lines that were formerly an attraction to engineers as well as the public.

Ford organized conversion of its plants to war production along customary channels, which were expanded to cope with a task many times greater than experienced with normal automobile-model changes. First step was to assemble manufacturing data on assigned projects. Since these were new to the organization, Charles E. Sorenson, Ford vice-president, personally headed a corps of engineers, metallurgists and production experts who visited plants of other manufacturers already engaged upon similar work. Then, under Mr. Sorenson's guidance, a practical manufacturing layout was developed to suit Ford methods and size of contract.

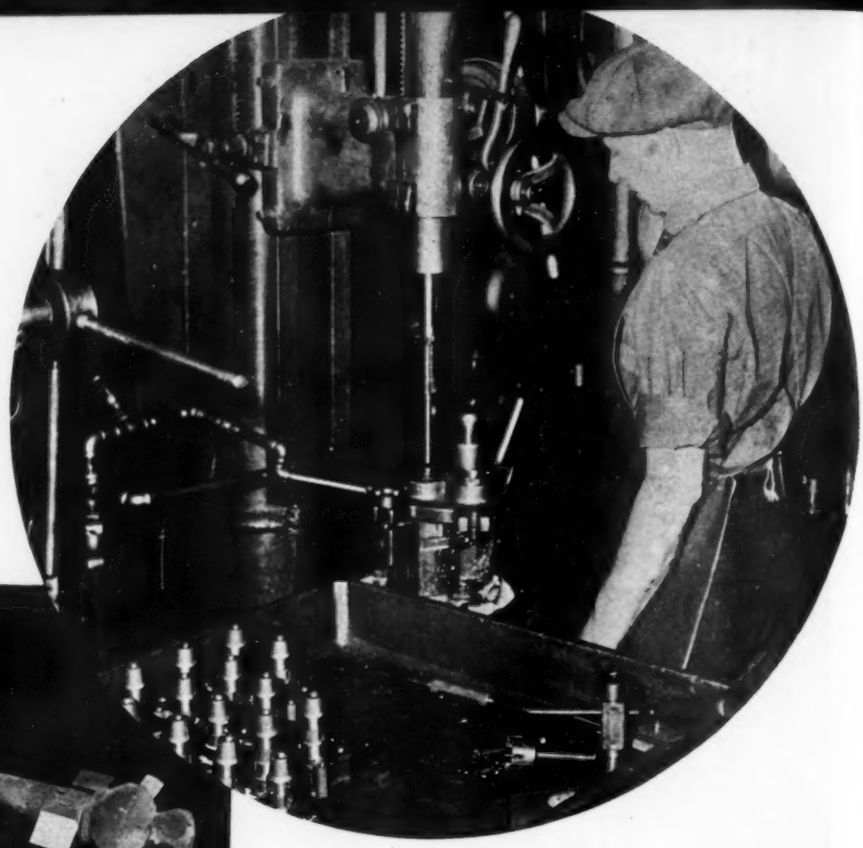
Blueprints, secured from the government or the original armament manufacturer, were redrawn to Ford standards. Full-scale wood models were built in the pattern shop to help engineers and production men visualize methods of simplifying the design of parts and processing. Always noted for encouragement of experimentation, Ford is applying information and techniques so learned to armament production. Metallurgists, for example, have cooperated with engineers to apply the steel-casting art to scores of parts for engines, tanks, armored vehicles, in order to save metal and machining time. Production engineers, brushing aside statements that "it can't be done," designed tools for the forming and piercing of armor plate.

Through the cooperative effort of supervisory, engineering and metallurgical talent, processing layouts were established for all parts entering into a given armament item. These layouts were then employed for the following purposes: (1) selection of suitable machinery on hand, (2) purchase of needed equipment not available in Ford plants, (3) tool design, and (4) plant layout.

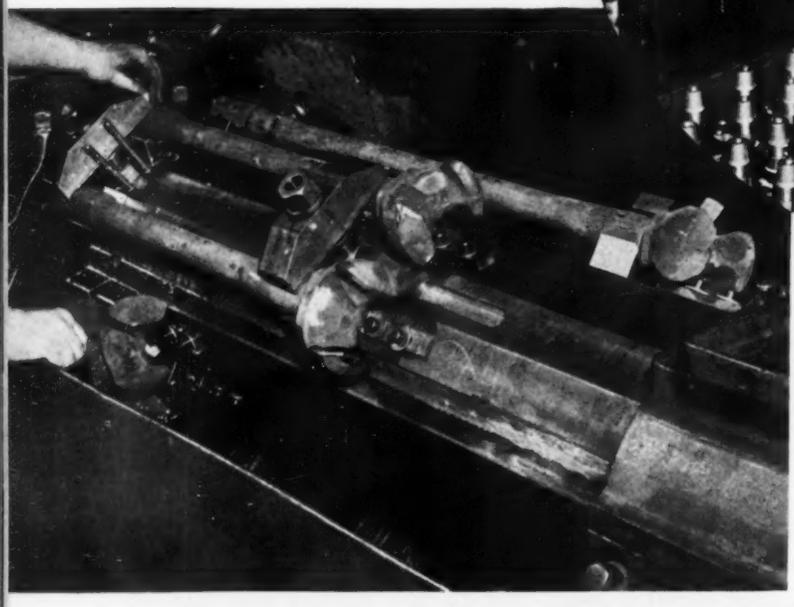
The machining of castings and steel parts is segregated in the Rouge Plant. The foundry machine shop handled thousands of parts going into motor cars; other departments machined steel

Oil-pump bodies for Jeep motors are drilled and reamed in a three-station indexing fixture on a production drilling machine

Shaft hole and gear hole in the oil-pump body are line-reamed concentric to a 0.0005 in. limit, using a two-position fixture and interchangeable double-piloted reamers on an old Sibley drill



Out of surplus stock came this old drum-type David & Thompson miller, which has been fitted with fixture to mill a complete set of front-axle drive shafts to length at each revolution



Rebuilt to equal a No. 2 in work capacity, this 20-year old Warner & Swasey No. 6 turret lathe has been fitted with hydraulic turret movement to remove hard time-consuming labor from loading and unloading the 36-in. front-axle shaft. Note bed extension at left

forgings and bar stock. This situation required careful analysis of machine loading when engaged in armament production. Routing charts for parts use color symbols to denote material—yellow for castings; green for steel. Part names are listed vertically at the edge of the sheet, types of machines across the top. Machine hours for a given operation upon a part are inserted in the proper square under the type and size of machine as specified on the processing chart. By summing up machine hours for each type of machine, the manufacturing engineer's office finds out the number of machines required in the various departments handling cast and steel parts, respectively. The purchasing department refers to the totals, compares them with the machine inventory list, and determines purchase requirements.

Charts Aid Several Groups

Processing charts for parts carry a rough estimate of the number of tool building hours required for jigs, fixtures, gages needed on listed operations. This information is useful in several ways. The toolroom superintendent obtains a picture of requirements well ahead of the time that tool drawings enter his shop, and is better able to plan efficient full-time utilization of facilities under his control. The purchasing department proceeds to line up vendors for the overflow tool work, and to make commitments for tool building hours in shops with the proper experience and equipment. Tool Design, from previous experience, can judge the number of men needed to complete a specific task in a given time.

Ford's plant layout department has a speedy method for developing sectionalized layouts for quick criticism by all concerned—supervision, engineering, department foremen. The key layouts for the selected building is drawn from the file to determine how much space can be made available for a given armament job. For example, in a certain branch plant it was seen from the original layout that two strips down through the plant could be utilized for machining and assembly operations by removing welding machines and final assembly lines for motor cars, but that it would be too expensive to clear out the plant altogether.

Upon a photostat of the key layout, a suggested arrangement of equipment for armament production is quickly dubbed in. Detail layouts of 125× 180 ft. sections are developed by arranging machine cut-outs upon sheets of fiberboard. These boards are ruled for building-column spacings. A photostat of the section layout is made to the scale of $\frac{1}{8}$ in. per ft. if desired, the photostats can be trimmed and pasted together to give a complete picture of the suggested arrangement. Sometimes sectional layouts are revised four or five times, the fiberboard with machine cut-outs in place being filed in vertical racks for this purpose. Altogether some 500 "boards" have been made up by the layout department for the conversion problems encountered in Ford plants.

Machine cut-outs on each board are lettered with the brass-tag number or the purchase order number for the machine, indicating respectively whether the machine is on hand or must be obtained from a machine-tool builder. Copies of layout sheets are furnished to Ford millwright foremen and production department foremen.

Selected examples of war work now in production in Ford plants will show some of the problems encountered and the steps taken to utilize available equipment. Other contracts received since the first of the year are in the production stage, but military considerations forbid disclosure of details concerning them.

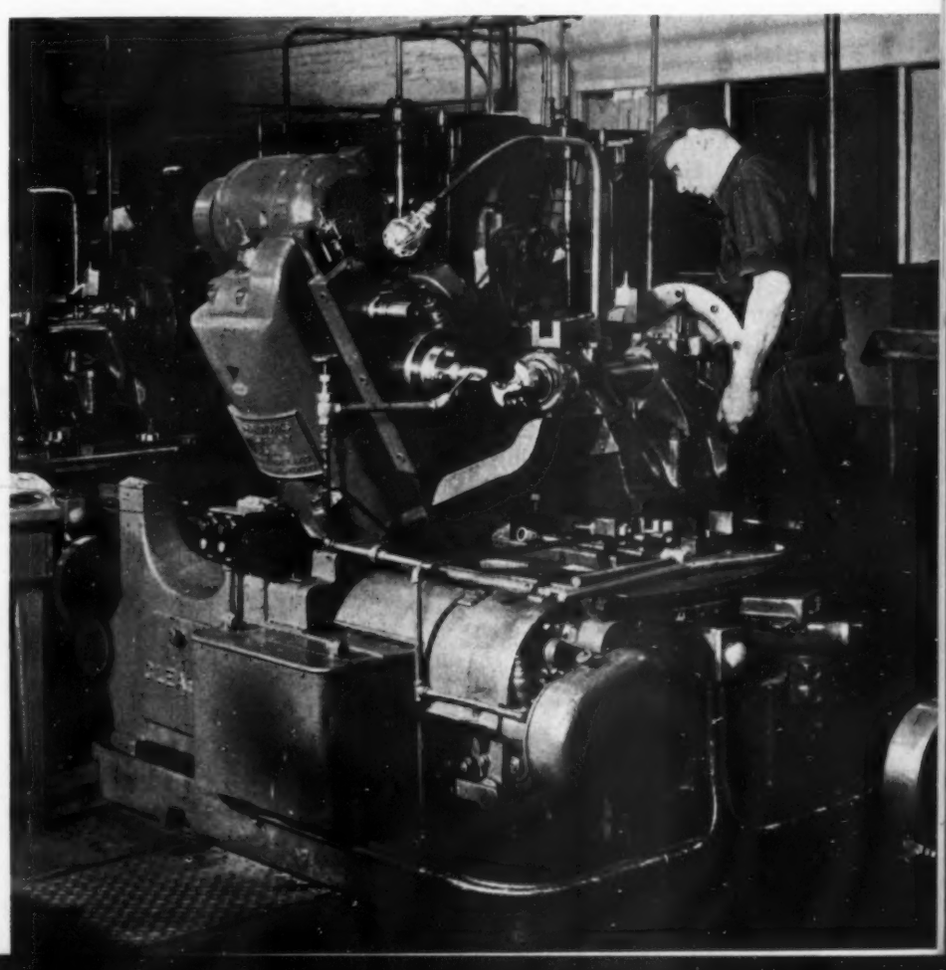
In six weeks, the Ford Motor Company got into production of a four-cylinder engine for Jeeps, or small command cars, officially known as the truck, $\frac{1}{4}$ ton, 4 × 4. So far as the motor building is concerned, only one new machine was purchased, and that for cost-cutting reasons. All other operations are handled with existing machinery and equipment, either partially modified or not at all.

Foundry Roughs Motor Blocks

Blocks are received from the Ford foundry with the cylinder walls finished and other surfaces in semi-finished condition. The Motor Building proceeds to make the finish cuts and to assemble and test the motor at the rate of several hundreds daily. Finish machining operations include: main-bearing bores, cylinder-head face, press in and ream valve-guide bushings, press in and machine front camshaft bushing, mill the oil seal and slinger grooves, and machine the thrust face on front main bearing.

The changeover of equipment and methods in the motor building was

New timing, spindles, spindle head and fixture put this Gleason, a veteran of the last war, into shape for milling ball pockets in the universal-joint connection of front-axle truck shafts



The operator at the left is intent on getting the most out of his old Landis hand-feed grinder, even though hard work is involved in grinding the bearing surfaces on long axle shafts. Meanwhile machinists at the right are making a second unit ready for increased production

principally concerned with the greater height of the four-cylinder Jeep engine block—approximately 6 in. more than the V-8 block. To finish bore all main bearings with the caps assembled, a tunnel-type Springfield boring machine required packing up the head and complete revision of the hydraulic system.

To ream all valve-guide bushings at once, the head of a Footburt drill press was lifted 14 in. Formerly this machine drove studs into the V-8 block. Floating reamers are piloted, the pilot entering the valve guide before the tool starts to rotate, a feature that avoids tool breakage and permits holes to be reamed perpendicular even though as much as 0.020 in. eccentric to the spindle centerline.

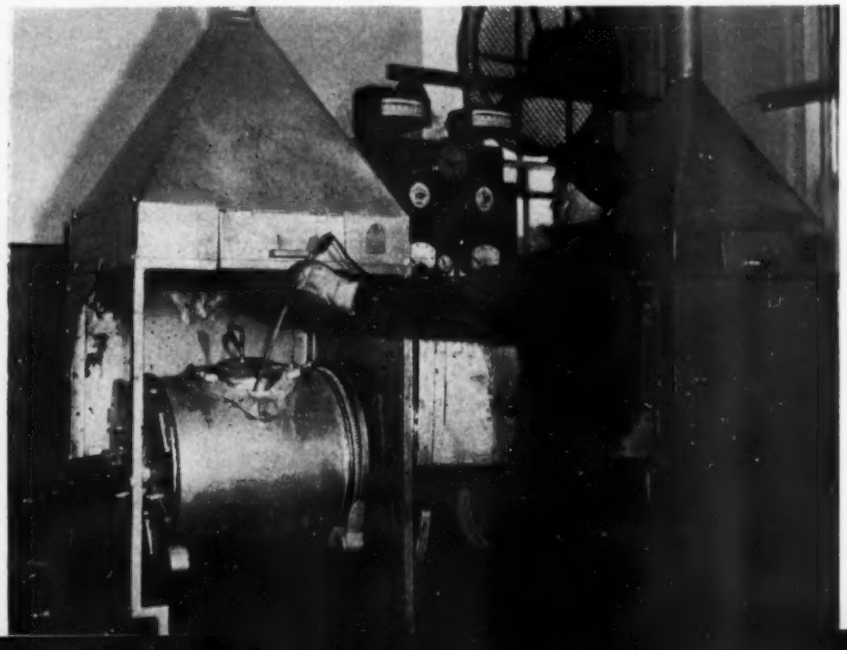
A horizontal machine that was used to press out the wristpin bearing in the V-8 motor-reconditioning department has been rebuilt to press in the camshaft bushing at the front of the Jeep motor. Production quantities allow the camshaft bushing to be rough and finish reamed by hand to within 0.001 in. of alignment with the three other camshaft bearings already reamed in the block by the foundry.

To drill and ream the anchor-pin hole in the main bearing, a special two-position head has been applied to a drill press. By indexing 2 in. laterally after drilling, the anchor-pin holes in the three main bearings are brought under the reamers.

At one time a Newton two-head vertical mill rough and finish-faced V-8 transmission cases in the foundry. Now this machine is part of the Jeep-engine line, but only one head is operative to finish mill the cylinder-head face.

For V-8 and six-cylinder motors, Ford normally does all machine work on parts in the originating department, finished material arriving at the motor assembly line via conveyor. Production quotas on Jeep engines are not sufficient for many Ford refinements—for ex-

Arc-type electric furnaces of 125 lb. capacity melt bronze alloys for small bomber bearings and bushings. A 600-lb. propane-fired furnace produces melts for larger parts, especially those made of manganese bronze



Local labor, trained by the village-industry management, turns out a surprising volume of small bronze parts for the war effort. Electric power lines for general-purpose machine tools follow the baseboard, leave the overhead area clear for moving material and improve shop lighting

ample, constant-temperature rooms in which uniform-weight piston-connecting rod assemblies are made. Hence there are no parts conveyors over the three assembly conveyors upon which the Jeep engines are built up in progressive stages.

Machines in Assembly Line

Equipment is installed between the first two conveyors for the purpose of making the crankshaft, flywheel and clutch assembly, and dynamically balancing and drilling as required. At another point, a locking-pin hole is drilled in the rear main bearing and oil-drain pipe assembly.

With a few hours work, the Jeep-motor assembly conveyors could be returned to regular passenger-car engine work. The original engine cradles or dollies merely have a few new lugs or supports to hold and position the Jeep block as required.

Pistons are fitted as the conveyor moves, then taken to a nearby bench, where connecting rods of uniform weight are assembled, and returned to the proper engine.

When the Jeep motor is completely assembled, brackets are bolted to the ends. These brackets are so designed that regular V-8 dynamometers can be employed for block testing. Moreover, the brackets fit supports in standard-equipped railroad cars.

Accessories and subassemblies for the Jeep motor required retooling of machinery in the motor building. Approximately 25 machine tools were affected by a shift from the V-8 oil pump to the Jeep-motor pump, which is considerably shorter and of different design.

To drill five holes in the oil-pump body, a new head and fixture were applied to a production drilling machine. The indexing fixture has three positions —one loading, the second for drilling under a five-spindle drill cluster, and the third for reaming three holes. When the cover is matched to the body, all five holes are in exact alignment although processed over different fixtures.

The cover for the pump has a crescent-shaped protuberance and two machined faces. A new chuck, toolholders and toolblocks were applied to a Warner & Swasey turret lathe. Stellite tools are employed. The back slide roughs the two faces, the front toolblock finishes the two faces and cleans up the end of the crescent. Roughing and finishing tools in the turret toolbars turn the outside diameter of the crescent and the shoulder between the two faces in the same set-up.

To ream the drive hole in the oil pump housing in relation to the gear chamber within (0.0005 in.) a piloted reamer is fitted to an old Sibley drill. The tool is piloted top and bottom in the fixture. A similar reamer of larger size is employed to ream the gear chamber.

Glass Plant Converted

When the new 90-in. grinding and polishing line of Ford's Glass Plant in the Rouge went into production in 1936, both engineers and the public displayed keen interest in an outstanding technological development in manufacture of automobile safety glass. Today, glass furnaces and enormous automatic sheet polishers and grinders stand silent along one side of the building while machine shops occupy the areas in which polished plate glass was transformed into safety-glass windows,

windshields and ventipanes for Ford, Mercury and Lincoln motor cars.

One section of the glass plant was cleared out to house a department that makes front-axle drive shafts for 1½-ton, 4×4 trucks. Later, a much larger area with suitable craneway was re-tooled for large components of armored vehicles.

Much of the equipment employed to machine front axle shafts is seeing service in a second World War. Recovered from surplus stock or from plants to which they had been sold, these machines are giving a good account of themselves in relieving a bottleneck in the truck production program. Very few units in the line came from Rouge production shops for the reason that Ford auto-plant tooling has tended toward the latest special-purpose high-production types.

Each military truck requires four front axle shafts—one long, one intermediate, and two short, each with an integral forged claw end for the universal-joint connection. Forgings are supplied from the Rouge Plant.

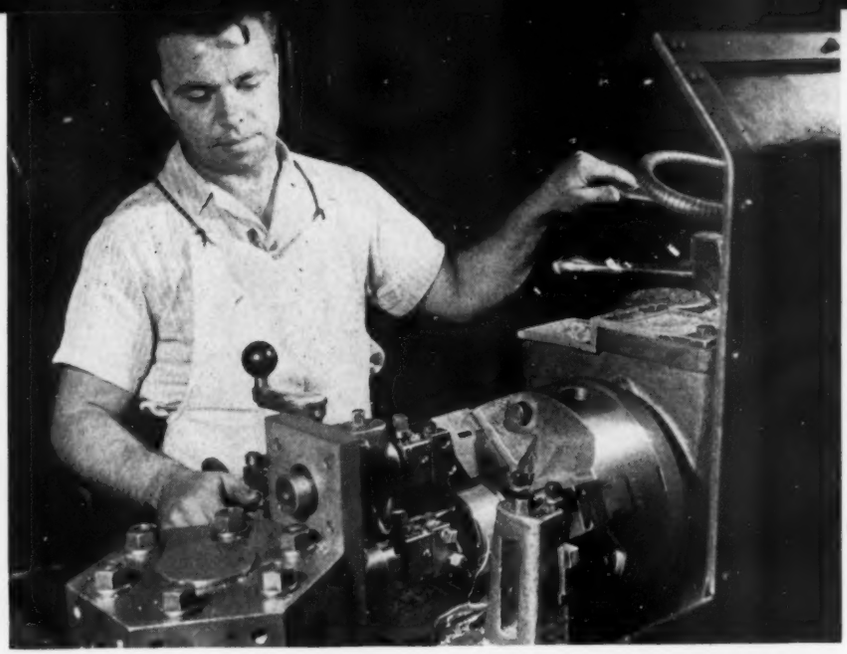
Axle-Shafts from Old Units

Axle-shaft forgings are straightened upon a conventional press, then milled to length on a drum-type Davis & Thomson that has seen at least 20 years' service. Each drum surface is fitted with fixtures for shafts of a particular length, so that one revolution produces a complete set of shafts for one truck.

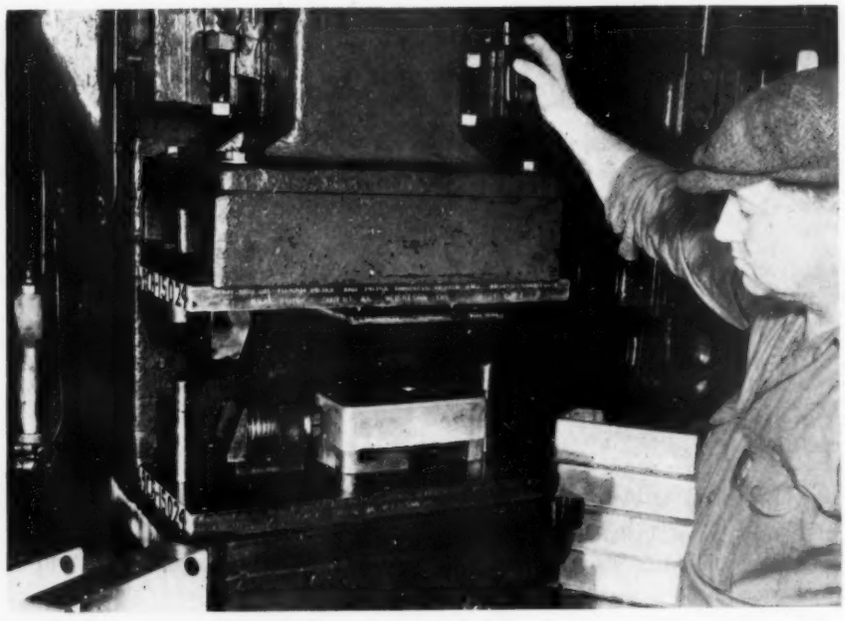
After centering on a homemade double-end machine, short and long shafts go their respective ways over a combination of old and not so old equipment of suitable size characteristics. Elderly LeBlond lathes turn the bearing surface and spline diameter on long shafts: two re-tooled Bullards do the same for the short shaft in roughing and finishing setups. Like auto-plant practice, short shafts slide down a rack from the second Bullard to an eight-spindle Cleveland spline hobber. Intermediate and long front-axle shafts are processed on a similar Cleveland of suitable swing.

Two-wheel Cincinnati grinders finish the bearing diameter of short shafts; Landis 20-year-olds are assigned to the long ones.

Short and intermediate shafts can be handled on a Bullard, for turning and facing the ball seat of the universal joint. Interchangeable chucks and collets hold these two workpieces. Not so with the long shafts, which are machined upon an old Warner & Swasey No. 6 turret lathe that has been rebuilt, to equal the capacity of a No. 2.

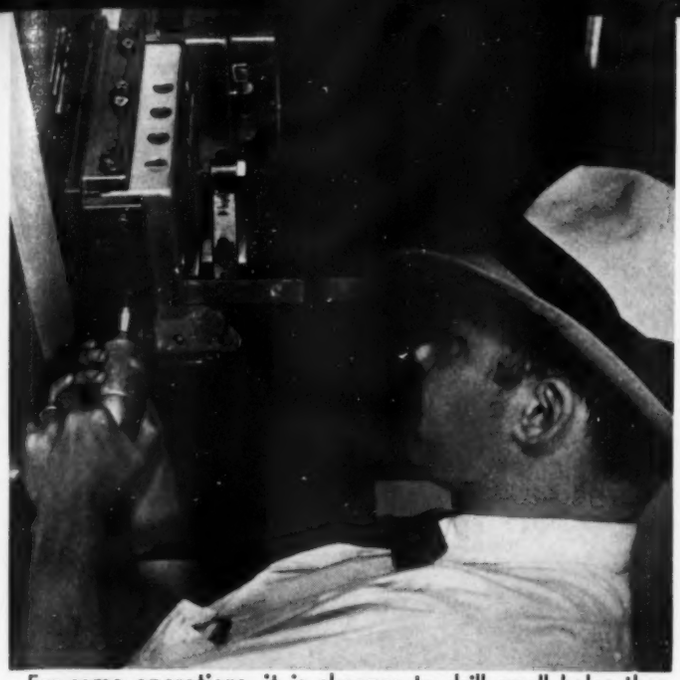


A spider at the rear of bronze bushings has been found effective in resisting the pressure of chuck jaws, it is cut off after the bushing is finish turned to 0.001 in. limit for out of roundness. Carbide-tipped tools are used for most operations in this plant



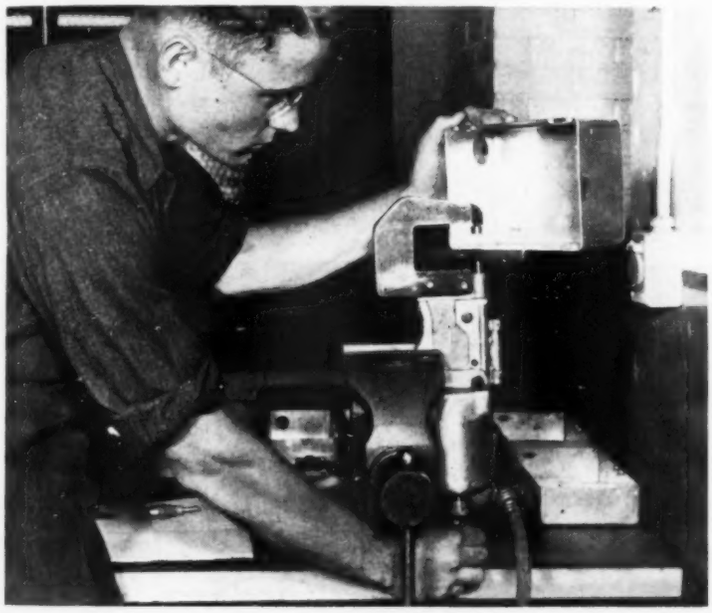
Because of short runs on aluminum junction boxes for bombers, die details are made interchangeable in a limited number of die sets. In this set-up, piercing punches are located in the spring pressure pad on the upper die shoe, and a cam-operated side punch saves an operation

The rebuilding of this old turret lathe shows what extremity can force production-minded men to do. A hydraulic motor operates the turret feed-screw to remove the labor of cranking the turret back and forth over a long travel when putting the 36-in. shaft into and taking it out of the collet chuck. A 12-in. extension bolted to the bed gives the turret a resting place in the back position. And a bridge with gibs is placed athwart the ways to steady the turret slide and avoid movement arising from excessive overhang. A pilot bushing plate was also planned to hold the tools steady while straddle turning and cherry reaming. Operations that this old rebuilt machine does upon a tough steel forging are: (1) face, (2) chamfer, (3) bore, (4) cherry ream the center ball race.



For some operations, it is cheaper to drill small holes than to pierce them. Here the operator is drilling several sizes of holes with a high-speed air-driven drill, using one of the few drill jigs found necessary in the production scheme

To drill nameplate-fastening holes in the face of a box containing various instruments, a simple bushing plate taking location from the instrument holes is found sufficient for the quantities involved



The wire catch for Zeus fasteners must be installed inside the box with a compression riveter. The wire is fastened first into two flat-headed rivets, which are inserted into pierced holes in the box

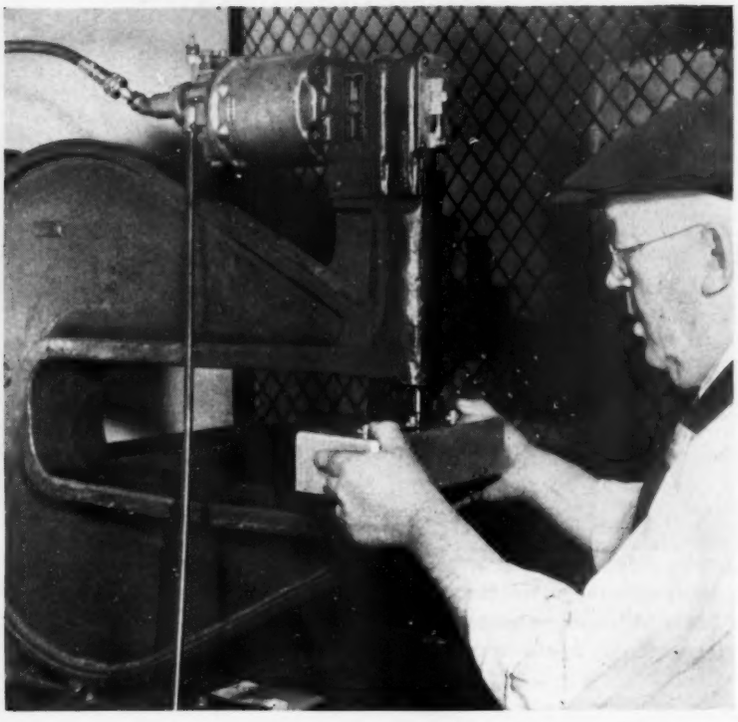
To install in the box cover the wing-headed bayonet-lock portion of Dzus fasteners, a hole is pierced, then dimpled, so that the shank of the device can be inserted. Then a piloted punch flattens the metal

Four seats for the outer balls in the universal-joint are milled upon old Gleason machines that worked upon the Fordson tractor in the last war. These machines have been rebuilt, and new indexing fixtures applied.

Because of the characteristics of the ball joint, grinding of the races is not required after carburizing in a Rouge heat-treating department. Shafts are returned to the Glass Plant, however, for regrinding of the bearing journals. Short shafts are handled conveniently upon a double-end automatic Cincinnati grinder of modern design. But the longer shafts were fated to be ground on Landis hand-feed grinders of ancient vintage. When originally used in production, these machines were connected to a centralized coolant sump and filtering system. Now each grinder has its own sump into which coolant drains through a cloth filter bag, and clean coolant is recirculated by pump.

"Waste nothing" is one of the cardinal points in the Ford production philosophy—not even a nail in a piece of packing case lumber! Operations in the Rouge are conducted on such a scale that a number of salvage opportunities have been converted into highly successful small business enterprises. Case in point is one of Mr. Ford's village-industry projects. Before the war one small factory remelted copper trimming waste from radiator-core and commu-

Squared-shanked rivets are placed shank up for staking under a Chicago riveter that has been fitted with a horn. The two-position rivet set is held on the anvil with dowels



Switches placed in the bottom of a box are squeeze riveted on a Chicago Pneumatic compression riveter. Controls allow the rivet set to come down slowly until in contact with the rivet, then apply upsetting pressure for a predetermined time

Five fittings for wing landing-gear drag links vary so little that they can all be accommodated in a special chuck while precision boring and facing to a 0.004 in. limit.

Concave or convex surfaces on forged-aluminum engine supports for bombers are milled in permanent fixtures that depend upon a cam to control table in-and-out feed. Spiral milling cutters provide good finish on such operations

tator-bar stock, produced welding tips and welding-machine jaws for production equipment in the Rouge Plant. During the six years that this plant has operated, 90 percent of the employees have been recruited from the local high school and 30 percent of them have been trained in all phases of melting, casting and machining copper alloys.

With the shift to war production, the village-industry's toolroom first gave aid to the defense program by making a number of small jigs, fixtures and dies for the bomber contract. Tool production still continues for outside needs.

In addition to alloy copper materials for welding purposes, the plant now melts bronze alloys in ten different government specifications. Each heat is recorded and samples are sent to the Rouge Laboratory for chemical and physical checks before conversion into bushings, thrust washers, latches and numerous other parts needed on the Ford bomber and other armament contracts. At least three-quarters of the power consumed in this plant to melt electric-furnace charges, operate heat-treating furnaces and run machine tools is secured from a hydraulic turbine, the customary power source in Ford village-industry plants.

Bronze Parts Cut Rapidly

Fortunately, machine tool equipment has been speeded for copper alloys, and hence was immediately suitable for employment on machining bronze castings for the war effort. To make a certain manganese-bronze bushing (225 to 260 Brinell) three operations are performed on turret lathes. To resist crushing in chuck jaws the casting has an integral three-legged spider in one end. In loading the piece, the spider legs are positioned under the chuck jaws, and they enable the part to be finished to a 0.001 in. limit for roundness, even though finished dimensions of the bushing are $1\frac{1}{2}$ in. long, $3\frac{3}{4}$ in. outside diameter, $3\frac{1}{2}$ in. inside diameter, and the wall thickness is $\frac{1}{8}$ in.

Original wall thickness of the cast bushing is approximately $\frac{1}{4}$ in. In the first operation, the rear end of the casting (at the spider) is turned for a chucking surface. In the second operation, the bushing is chucked on the turned surface, and the spiders are positioned under the chuck jaws. The outside and inside diameters of the bushing are roughed to within 0.010 in. of finished dimension. In the third operation, the part is chucked again in a manner similar to operation No. 2, and the outside and inside diameters are finished to final dimensions, the open end of the bushing is faced to length, and the part finally cut off from its supporting spider. The spider and chips are returned for remelting, and no material is lost. Carbide tools are employed for all of the diverse machining operations in this plant.

Spectacular phases of building bombers—rows of fuselage in assembly or the riveting of a huge wing—may distract attention from the problems of making

many small parts and subassemblies without which the ship could not take the air. In the aggregate, controls and fittings consume a respectable portion of the man-hours needed to build one plane. Quantities of each item are small as automotive standards go, specifications and materials differ markedly from conventional products.

Bomber Parts Under Way

Ford has sandwiched the manufacture of bomber parts into a number of buildings at the Rouge Plant, the Lincoln Plant, and into a number of the village-industry plants. Considerations of available manpower and equipment have been reviewed in selecting points where these departments, often small, shall go.

Ford stamps the junction boxes from aluminum coil stock, assembles purchased switches, instruments and lights to body or cover of the box as required. As a stamping proposition, quantities are limited for any one part. To reduce die cost, four draw die sets handle boxes ranging approximately from 2×4×2½ in. deep to 6×12×3 in. deep, through the use of interchangeable details. Die changes can be made in from 15 min. to one hour. All told, approximately 100 different die combinations may be used to draw and pierce the sixteen boxes and sixteen covers. Pressure pads, drawing radii and punches are chrome-plated to avoid scratching the aluminum. Boxes are made from 2SO aluminum; covers from 2S half-hard to resist distortion.

To trim drawn boxes and covers, Ford will not employ expensive trimming dies. Instead the stamping will be placed over a hat-shaped wooden form, and the excess metal removed with a saw fitted to a conventional wood shaper.

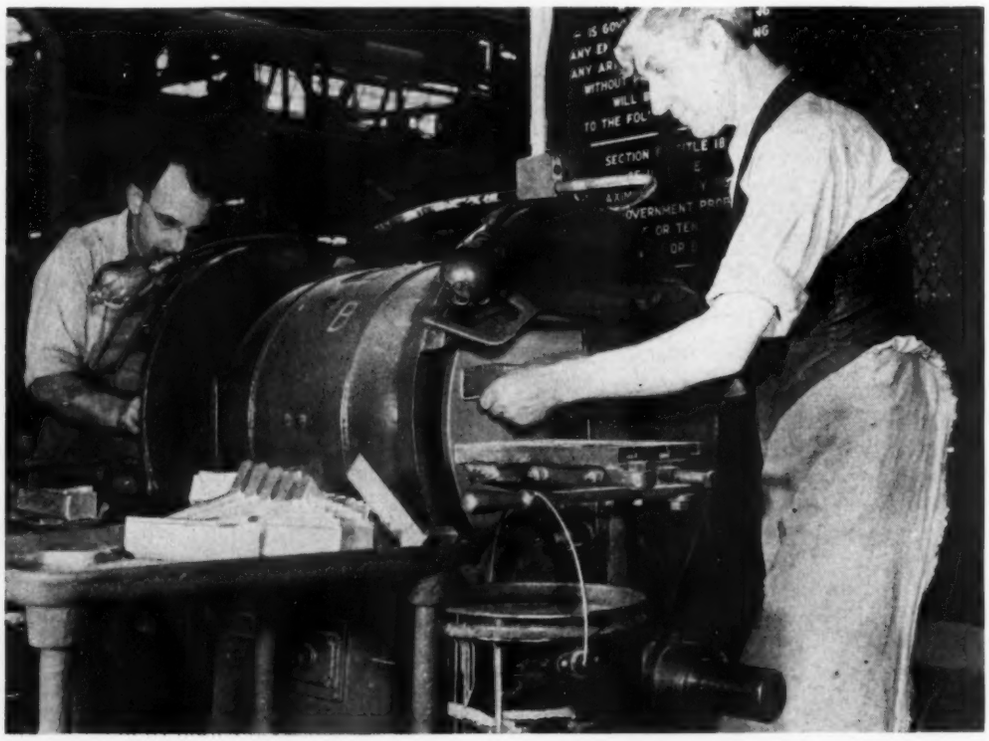
All connections to box or cover are riveted. Another factor influencing the choice of riveting for assembly is the expense of setting up to spot weld a low quantity of work to government specifications.

Many nooks and corners of the far-flung Ford operations are occupied with producing parts and subassemblies for the bomber plant. Some 296 different aluminum and steel forgings for bombers are being processed in the Lincoln Plant over general-purpose machine tools employing interchangeable fixtures to a large degree. For example, 150 parts are handled on a score of milling machines. Ford has followed the practice of supplying vendors of aluminum forgings with a die for each part, since it was foreseen that bottlenecks would occur if one die with inserts were provided to make a family of parts having slight variations. On milling operations, spiral cutters are employed where possible to achieve smooth finish. Tools can not be operated on forgings at the same speeds and feeds as on cast-aluminum cylinder heads, and Lincoln is developing fixtures, machining standards and coolant applications as it goes along.

Belt Grinders Often Used

One of the significant developments foreseen by Lincoln engineers is the application of abrasive-belt grinders to surface many parts and knock the corners off. Some of these operations can be done much more rapidly than by milling, by employing universal work rests or fixtures and holding the part against the belt by hand. A copious flood of water on the abrasive belt will remove the heat generated in grinding and avoid distortion of many of the parts and subassemblies.

Surfaces on miscellaneous aluminum bomber parts are ground flat by removing from 0.010 to 0.035 in. in free-hand grinding. Occasionally angular relationships between milled surfaces are conveniently corrected by using a universal workrest to hold the part at the proper angle for the grinding operation



Motor Cars to Munitions — **GENERAL MOTORS**

All-Divisions Output of War Goods Now Billion a Year, and Climbing

THE RESOURCES of General Motors Corporation are the largest in the automobile industry. Its 90 factories stretch from the Atlantic to the Pacific and from Canada to the Gulf. Its five car manufacturing divisions—Buick, Cadillac, Chevrolet, Oldsmobile and Pontiac—normally produce more automobiles and trucks than any other company.

General Motors, in fact, does around 45 percent of the country's automobile business, and sometimes the percentage rises nearer to one-half of the total. To be even more specific, for the calendar year 1941 the corporation accounted for 47.3 percent of new passenger cars registered by private consumers and 45.3 percent of all the cars and trucks. In the twelve months ended July 31, 1941, representing the period of the 1941 models, the corporation registered 49 percent of passenger car sales. One should remember that from August 1 to December 31, 1941, passenger car production was restricted by the government to 61.8 percent of that in the same period of the previous year for the corporation, a more severe restriction than was placed on smaller companies.

With its enormous plant facilities and mass-production-minded supervisors and executives, General Motors had much to offer Uncle Sam when war began. Its capacity for making metal products is about 10 percent of the country's capacity. Turned to armament instead of automobiles, this capacity used to the full extent would provide a good chunk of the arsenal which America was building to fight the Axis and Japan.

The fact is that General Motors didn't wait until Pearl Harbor. It worked closely with the Army and Navy even before the national defense program was initiated in 1940 and since then has been progressively devoting more of its facilities to work for Uncle Sam.

In the first quarter of last year the corporation produced war goods amounting to over $56,000,000. The volume jumped to $257,000,000 in the same quarter this year. It is mounting rapidly from week to week and month to month.

The scope of the corporation's war operations is indicated by the more than 1,000 orders and contracts for war materials now on hand. The products cover a wide range—machine guns, military trucks, aviation and diesel engines, tanks, complete airplanes, shells, guns, to mention a few.

Because of the enormous size of the job being done by General Motors, it is impossible to go beyond the ranks of the individual car divisions, plus Fisher Body, in the description of the corporation's conversion of plant and facilities set forth on the succeeding pages.

The reader should keep in mind, however, that all of the corporation's resources are now being devoted to one task—winning the war. Each department, each plant, each division of the General Motors nationwide organization is being utilized for the war job for which it is best fitted. Altogether the corporation is in the midst of an all-out effort to beat Hitler and Mussolini and Hirohito.

Finds Adequate Tooling Costs No More Than Makeshift or "Dirt-Floor" Methods

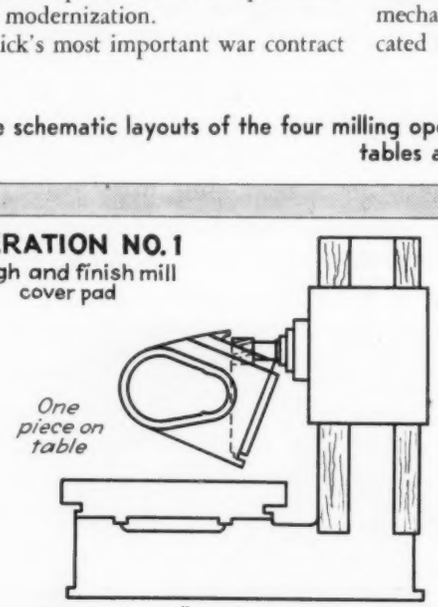
WHEN IN FULL PRODUCTION on more than 30 war assignments, Buick's rate of output, measured in terms of dollars, will far exceed the peacetime peak. Through a policy of making large annual expenditures for new machinery, this General Motors Corporation division possessed one of the most modern plants in the automobile industry upon outbreak of war. But the character and extent of munitions contracts and subcontracts calls for a makeready cost fifteen times greater than the average sum spent since 1934 upon auto-plant modernization.

Buick's most important war contract calls for production of aircraft engines in large quantities. Other prime contracts and subcontracts are designed to take advantage of the parts-production resources of the second largest self-contained plant in the automobile industry. In peacetime, Buick operated a foundry and a transmission department capable of supplying its own needs—fourth place in auto sales—and the requirements of other General Motors divisions. Important subcontracts like the transmissions and differentials for tanks and the traversing and elevating mechanisms for artillery were predicated to a large extent upon skill and resources in making forgings and gears.

In normal times the Buick forge plant employed 1,000 men upon specialized volume production of automotive forgings. Enormous output from a plant of this character tends to confuse the outsider into believing that it is capable of handling almost any armament forging that comes along. Automotive steels are not heavily alloyed, billet sections are commonly below 4 in. square. Hence drop hammers are mostly of 5,000-lb. rating, and the largest is of 16,000 lb. Furnaces are adapted to the production heating of comparatively light sections, and only hardening,

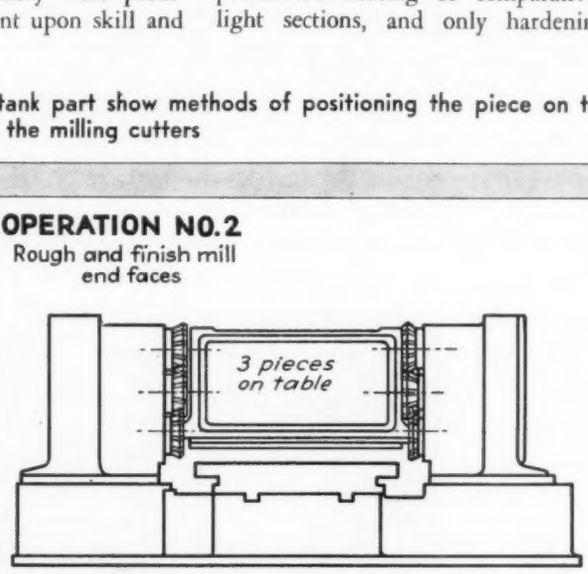
These schematic layouts of the four milling operations on a tank part show methods of positioning the piece on the tables and setting up the milling cutters

OPERATION NO. 1
Rough and finish mill cover pad



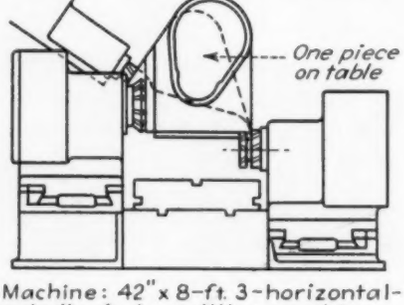
Machine: 54"x 60"x 8-ft. horizontal openside milling and boring machine

OPERATION NO. 2
Rough and finish mill end faces



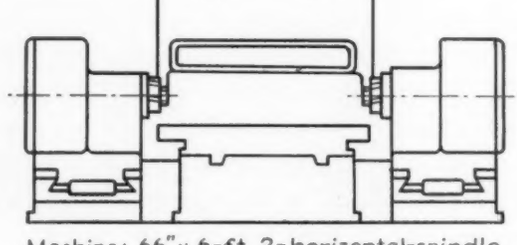
Machine: 66"x 14 ft. 8-horizontal-spindle duplex milling machine

OPERATION NO. 3
Mill back shoulder, floor board joint surface and top ledges



Machine: 42"x 8-ft. 3-horizontal-spindle duplex milling machine

OPERATION NO. 4
Mill vertical side strips



Machine: 66"x 6-ft. 2-horizontal-spindle duplex milling machine

quenching and drawing operations are required. Armament steels on the other hand are of heavier sections, 7 to 10 in. square in some cases, require heavy hammers for maximum forging effect (hammers up to 35,000 lb. are desirable), steels need more reheating, temperatures must be carefully controlled for more heat-treating processes—normalizing, hardening, extremely careful quenching and drawing.

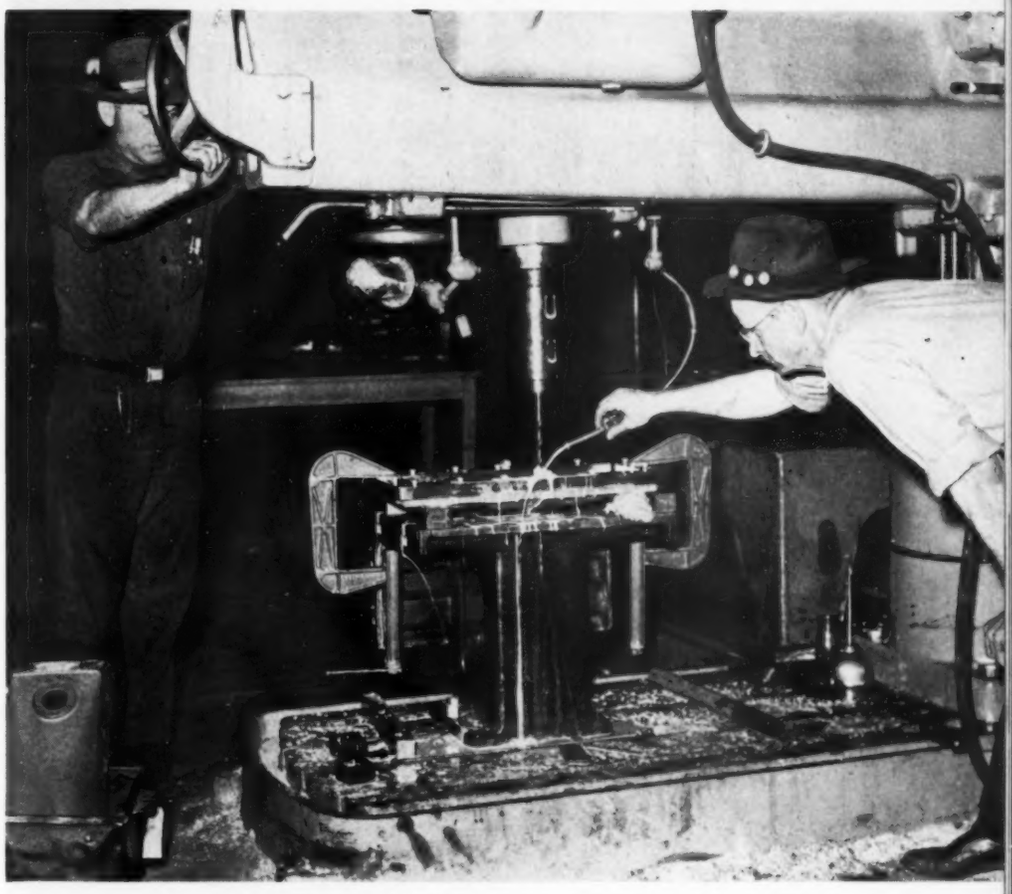
To prepare for the numerous armament forgings that Buick will make for its own use and for outside concerns, seven months were spent on making forging dies for upsetters and drop hammers. (Six Lucas mills will be kept busy in supplying upsetter dies during full production.) Auxiliary batch-type heating furnaces were built. These makeready steps were completed well in advance of receipt of material.

In operating what amounts to a combination of job shop and manufacturing forge plant during the war, Buick must teach its forge-shop personnel to handle more highly alloyed steels containing nickel, chromium and molybdenum in various combinations. Heats will be closely checked with optical pyrometers. Actual forging will be slower, production per man will be less than in automotive practice, tools will give only approximately 25 percent as much life. The last circumstance introduces the problem of securing die blocks in adequate number and size. Automotive tools are being reworked where possible.

Comparison of the setups for automotive and aircraft-engine crankshafts offers a concrete example of the extra effort and time required to produce armament forgings. The 130-lb. auto crankshaft was made in one heat from a billet $4\frac{1}{8}$ in. square by 42 in. long weighing 216 lb. The aircraft-engine crankshaft is made from a billet 7 in. square by $20\frac{1}{2}$ in. long, requires three heats, and takes six times as long to forge complete.

Reasons why Buick was assigned to make tank parts on subcontract for another General Motors division were: (1) a certain plant building could be adapted to secure headroom for lifting big castings into and out of large machine tools, (2) primary parts production facilities like the forge plant provided a good start on the retooling problem.

Hourly production quantities of tank parts must not be compared with automobile output, but Buick preferred to set up production lines on the theory that adequate tooling costs no more and will produce more accurate work than makeshift or "dirt floor" methods. Of the 1,000 or more machine tools that Buick will need on this phase of war work, some 30 percent in number and 20 percent in value will come from auto-plant departments. Approximately 75 percent of available hobbing machines will be utilized.



A temporary drill plate, positioned on the brake cover with scales, speeded early production, made use of a Cincinnati-Bickford radial purchased for the brake housing. A retooled Natco took over the drilling of the brake cover, using a permanent fixture incorporating locating points

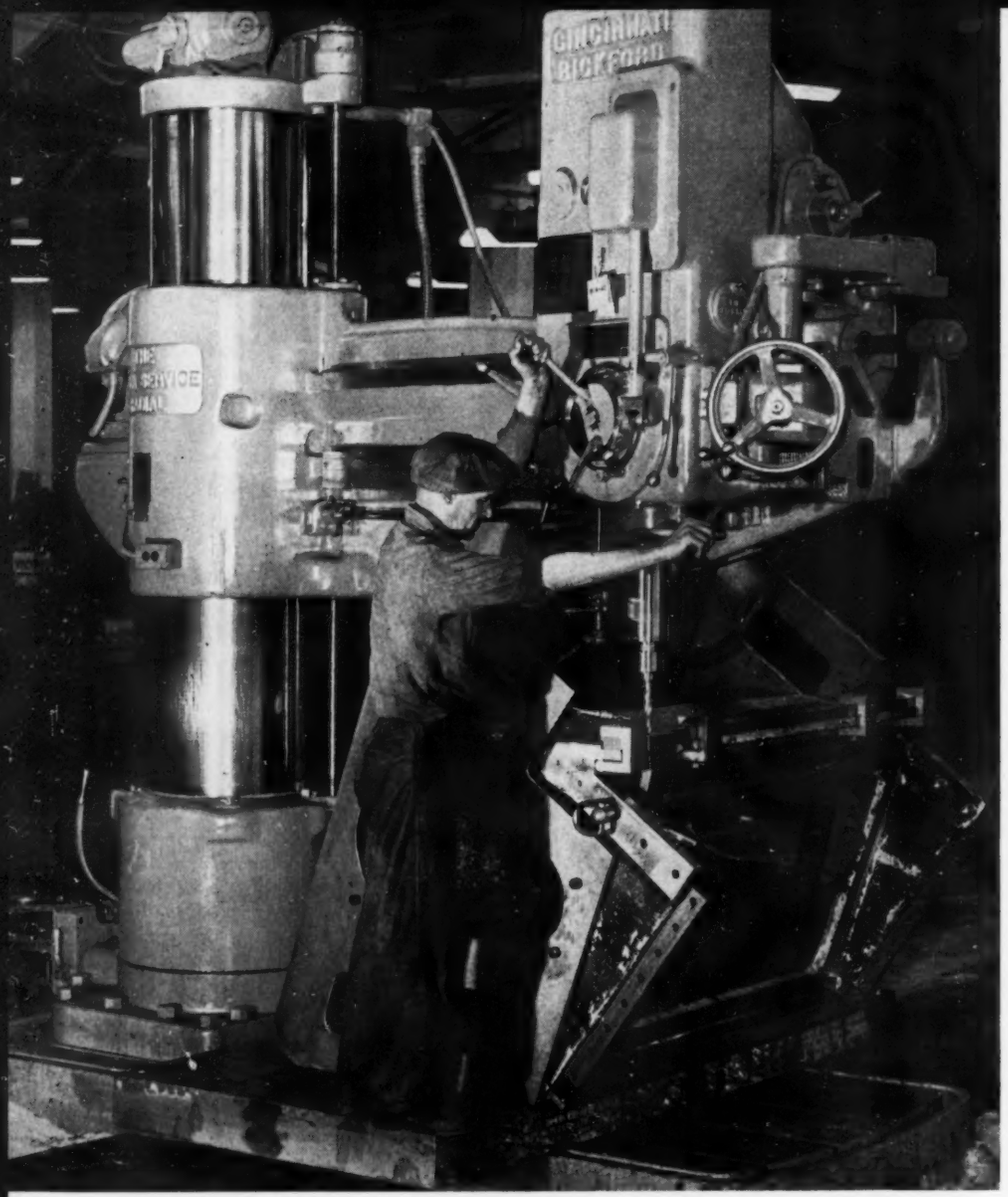
In auto practice, Bullard Mult-Au-Matics produced from 50 to 60 pieces per hour, whereas tank parts can not be produced at a comparable rate because of larger diameters and harder alloy materials. These jobs have been broken down so that three related sizes can be processed over the same machine, but with tool changes, output is cut. Where Bullards had to be bought, reasons were: (1) the cost of one Mult-Au-Matic is less than half of that for seven turret lathes to perform an equivalent amount of work, and (2) only one machine need be built by the hard-pressed machine tool industry.

Short and long shafts were sorted out, the shorter ones being assigned to existing Fay automatics, and new machines purchased to handle jobs of swing and length beyond the capacity of existing equipment. The same principle was applied to selection of equipment for grinding, of which there is a considerable amount in tank work.

There were no machines in the Buick plant capable of handling heavy castings for tanks on a production basis. Redesign of the former part has shifted the emphasis from boring-mill work to milling. Buick had no suitable milling machines of large size, since in recent years the processing of blocks and cylinder heads has moved toward broaching, and the other milling equipment was too special purpose for use on tank castings.

To process one of the more important tank parts, Buick will perform all of the milling operations in four setups. Operations performed on these machines are as follows:

OPERATION NO. 1—Ingersoll 54 × 60-in. by 8-ft. openside milling and



To get into tank-parts production before arrival of mass-production machinery, Buick made temporary end-plate fixtures for positioning a tank part under a radial for drilling and tapping several rails. Later the radial drill became a permanent part of the mass production line

angular rails are milled with a horizontal and an angular head on the opposite side of the machine.

OPERATION NO. 4—An Ingersoll 66-in. by 6-ft. duplex machine mills the lower side rail on each side of the casting.

These milled surfaces must be drilled and tapped. To avoid tedious setups under general-purpose machines, of which a great number would be required to get out production, Buick has specified way-type machines of immense size.

A three-way machine with a total of 118 spindles will drill both ends and the window on the differential casting.

A two-way machine will drill and tap the top and bottom rails.

A two-way machine will bore a half-circle in the cover opening.

The tooling problem for a heavy combination tank part calls for an adventure in machine-tool building. Principles learned in line-boring large bearing diameters in tank parts at the Detroit Tank Arsenal (*AM*—Vol. 85, page 1267) are applied, perhaps empirically, to huge double-end Snyder boring machines. The workpiece weighs 16,000 lb., must have a four-ton locating fixture bolted to it before loading into the machine. Spindle bars will bore the smaller external openings for drive shafts, then be pushed into the interior of the casting and larger slip-on cutters applied to bore holes 12 in. or more in diameter. To change tools several times is a tedious business. Actual machining time may be only ten minutes, but tool changes will consume an hour.

boring machine. One piece is loaded in the 13,500-lb. fixture built by Dayton Tool & Engineering Company, taking location from targets in the casting. A single cutter machines the "window" opening.

OPERATION NO. 2—Ingersoll 66-in. by 14-ft. duplex mill loads three castings for milling the cover face and side rail on each side of the part. Each side head carries three 13-in. cutters and one 26-in. cutter. One of the small cutters machines the rail, the other two machine the cover face, and the 26-in. mill finishes the cover face.

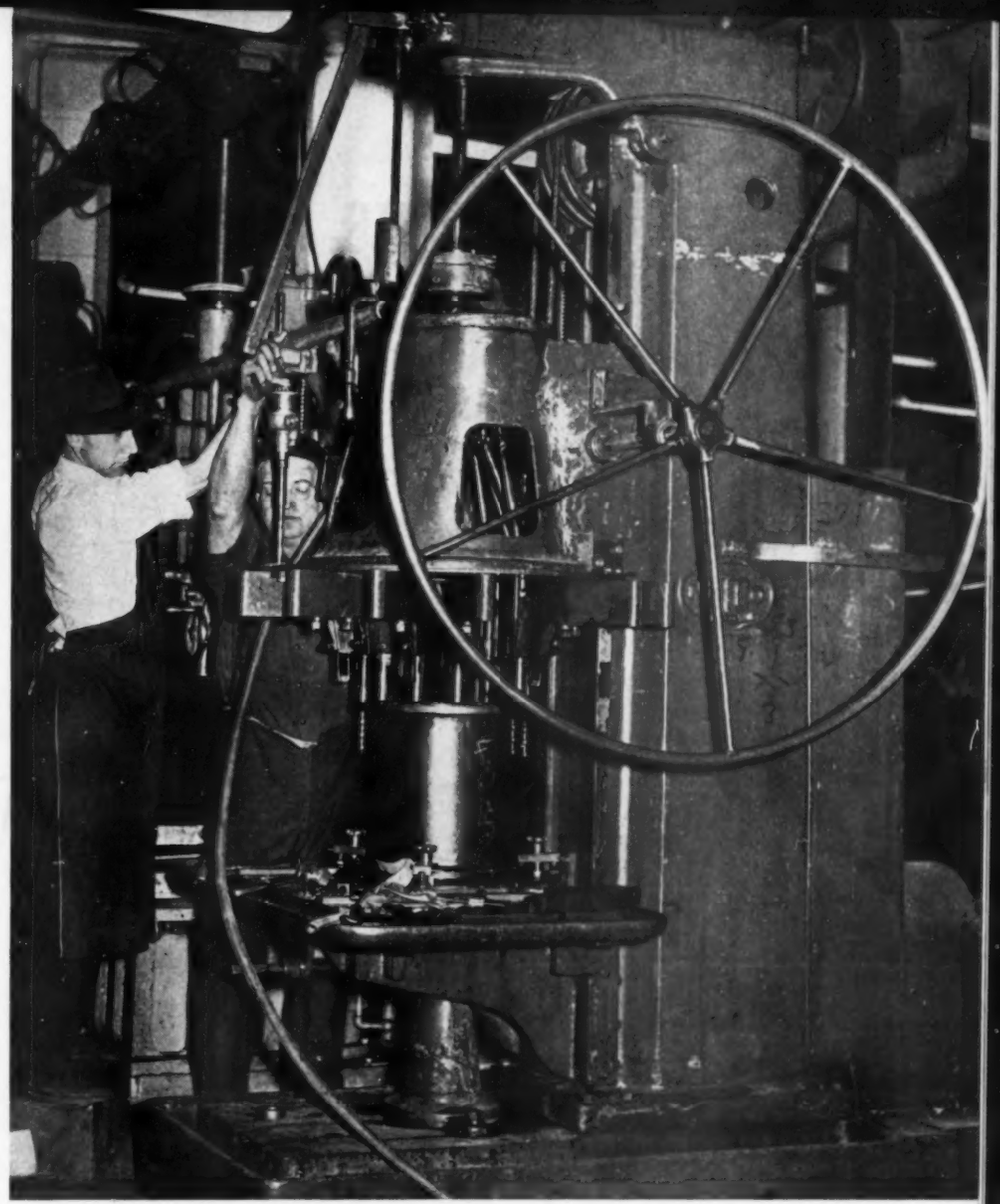
OPERATION NO. 3—Ingersoll 42-in. by 8-ft. duplex mill faces the floor-plate rail and the angular side rails on the opposite side of the casting. The floor-plate rail is straddle milled, while the

Once these Fay lathes roughed rear-axle pinions for Buicks; one is already working on brake shafts while the other is being made ready. To speed rebuilding, the slide feed cams were reversed and new contours machined

BUICK

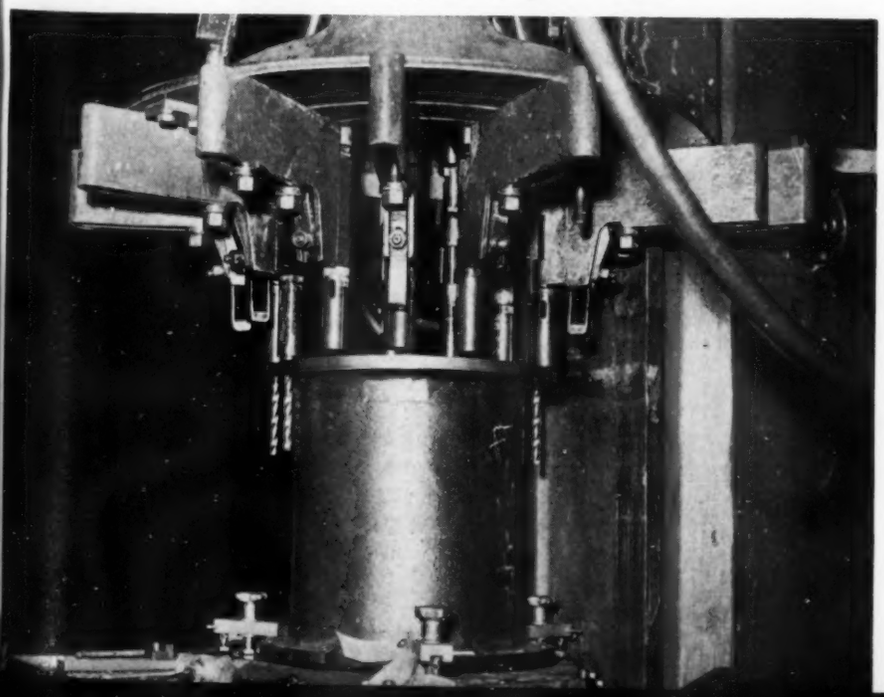
Buick has done all of the processing work necessary to a war-production program that calls for 18,000 tools, jigs, fixtures and gages. Flint does all the tool design and toolmaking possible with its resources. Process engineers have averaged twelve hours a day, six and seven days a week. Tool shop facilities have been operated to capacity 24 hr. per day, six days a week, with a modified seventh day. Outside engineering concerns and tool shops carry the remainder of the burden. Buick has bought tools in fourteen major centers, where from one to three men are kept in residence checking performance of vendors. Normally, only seven days elapsed from the time tool work was let until it began to take form in the finished steel product.

To back up production departments the Buick toolroom was stepped up in four months from 225 skilled men to 435 persons actually engaged upon tool production. Some 50 experienced men were hired, and 160 production workers with machine-operating skill were put on the payroll as upgraders. For 25 years, Buicks' toolroom has been able to make almost anything from an end mill to a machine tool. Standard tools produced include: end mills, reamers, shell cutters, circular form tools, dovetail form tools, broaches of all descriptions except involute spline broaches, all types of gages. Thread grinders are being installed in an effort to keep up with gage and tap wear occasioned by 100 percent inspection of aircraft parts. Six Lucas boring mills will be kept busy upon making upsetter dies for tank, shell and aviation-engine forgings.



A 30-year old Natco that formerly tapped the rear-axle banjo does its bit for the duration by tapping thirteen holes in a hub. While this oldster was undergoing rebuilding, an ancient single spindle unit was carrying on the job, drilling one hole at a time

The original spindle circle being too small, homemade arms were applied to the multiple-head casting of this machine to hold the spindles at the desired radius for drilling the flanges of the hub



Since the first of the year, Buick has installed a department to apply standard carbide tips to single-point tools for turning, undercutting and grooving operations. Tips are brazed to tool shanks, using a series of torches playing on the work. Hardened and ground gun drills are being butt welded to a hollow mild steel tube by a special interrupted-cycle welder that achieves uniform heating of both pieces and avoids splitting or cracking the hardened and ground tool. This development is an important attempt to avoid delivery delays for gun drills needed to produce holes from $\frac{1}{2}$ to $1\frac{3}{4}$ in. in diameter and up to 47 in. deep in a number of large aviation and tank parts.

Large Percentage of Old Machines Used Despite Radical Difference in Parts

This Hydro-Tel miller is contour milling the outside surfaces of cheeks on an Allison engine crankshaft. The master form at the right is reversible so that the surfaces on both sides of the crankshaft can be finished in the same set-up

MORE THAN a year before Pearl Harbor, the Cadillac Motor Car Division of General Motors Corporation began to manufacture a number of important parts for the Allison aircraft engine, setting up a separate division for that purpose. Today the remainder of Cadillac's facilities are rapidly being converted to production of a new combat vehicle.

When conversion is completed, Cadillac will be using more than 65 percent of its automotive equipment for war work. The balance, not suitable for war production at Cadillac, will be made available to other companies through the machine tool pool established by the automotive industry.

Every machine tool at Cadillac has been inventoried. If it can be used, it carries a tag indicating the war operation to which it is to be transferred. All tools are listed in a visible file record maintained in the office of the superintendent of methods and equipment. This listing shows the old location, new location, machine number and description of the machine. Colored tabs identify machines still not assigned to war work.

Before being delivered to its new location, each machine is put into good condition. Some have had to be rebuilt because the ways and slides had been worn unevenly.

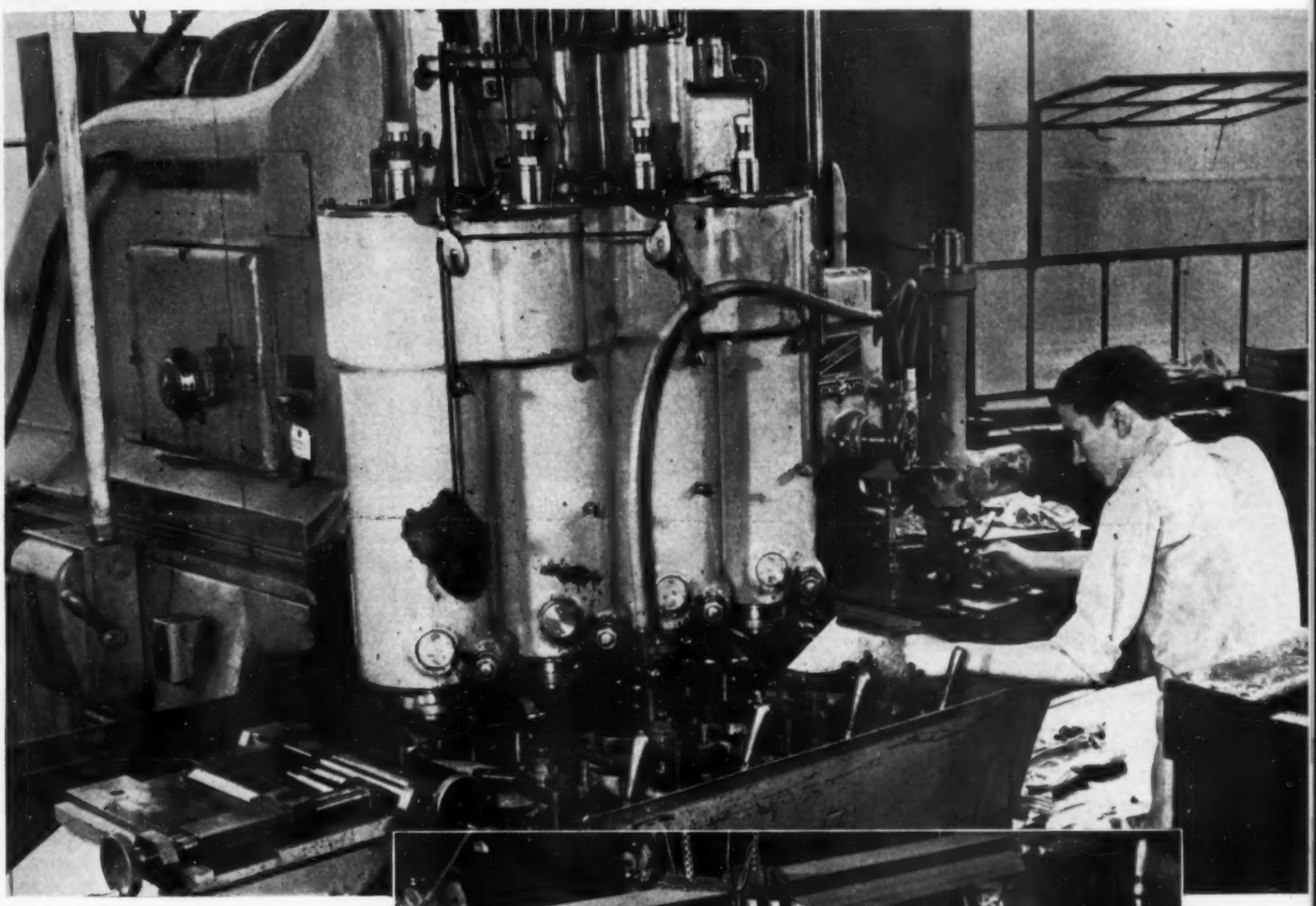
In view of the sharp difference between the parts being made by Cadillac in wartime compared with those made in peacetime, the fact is notable that Cadillac engineers have been able to convert such a sizable percentage of the company's machine tools. For example: the finished Cadillac crankshaft weighed only 90 lb. and required 62 operations, whereas the Allison aircraft engine crankshaft weighs over 100 lb. after 80 operations. There were only 25 machining operations on the Cadillac automotive connecting rod, as against 93 on the aircraft rod, with 55 times as many manhours needed to make the latter. With automobile production continued last year, 46 machine tools were transferred from automotive work to Allison engine operations. Only 47 additional machines would have been suitable for Allison parts manufacture if the entire automobile production set-up had been discontinued at the time the Allison work was started.

Standard Machines Used

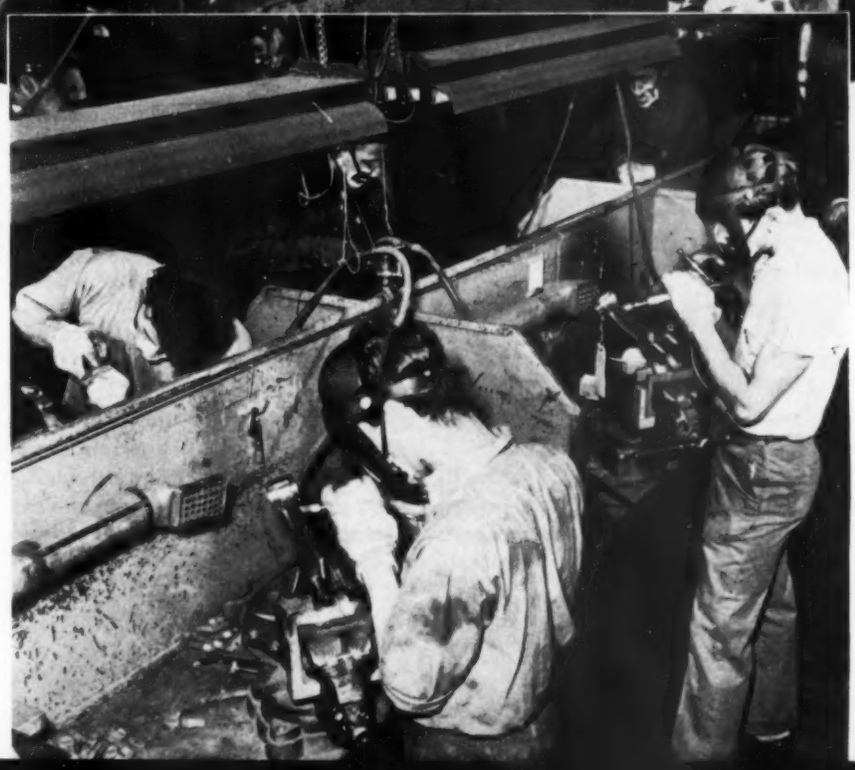
Practically all of the machine tools removed from the automobile production line for work on the Allison engine parts were standard drill presses, milling machines and boring mills, which had only to be put in first-class condition before being put to use. No rebuilding was necessary to increase their capacity or change their purpose. Of course, some fixtures had to be made for the jobs to which these machines were assigned, and new cutting tools supplied, but the machine tool conversion problems in this division were not at all complicated.

In contrast to the Allison engine job, the engines for the new combat vehicle resemble more closely the Cadillac automobile engine formerly made. With the exception of a slight modification in the final engine assembly line, the same machine tool equipment is being used as in peacetime. On the other hand, almost none of the tools em-

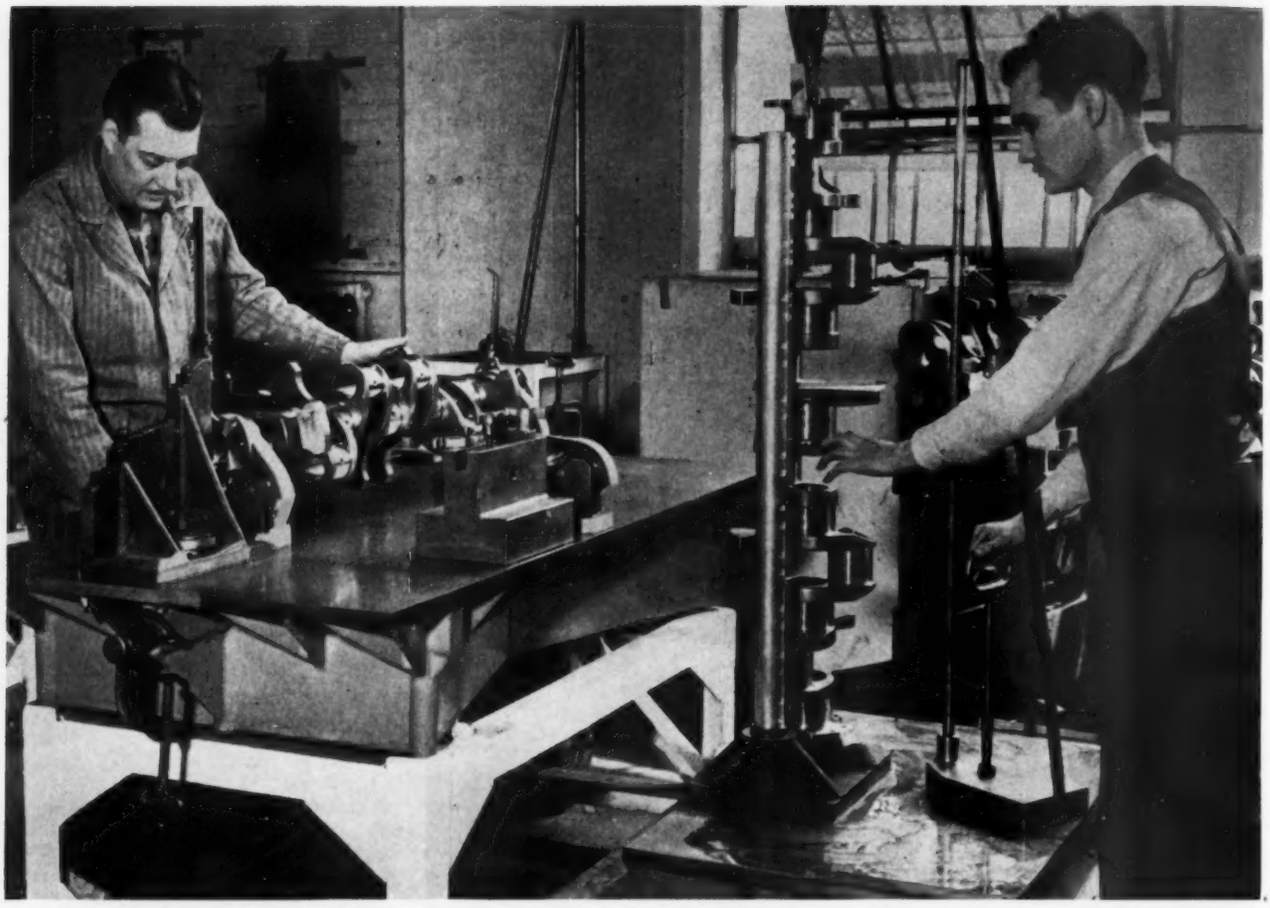
The influence of automotive know-how in tooling up for operations on the Allison crankshaft is emphasized in this set-up. Here, the No. 6 and No. 7 connecting arms on the crankshaft are being formed milled in a Keller automatic die sinker, using a 1/2-in. diameter high-speed ball end mill operating at 450 r.p.m., with feed in 0.096 in. progressions. The masters for each section are mounted on an indexing holder above the work, so that they can be swung easily into position as each new surface of the crankshaft is brought in front of the cutter



Four blade connecting rods are form milled at a time in this set-up on a Cincinnati Hydro-Tel miller. The table is of double length, the fixture at the left end being used for rough milling operations, while the fixture at the right is employed for finish milling the same surfaces



Known in the shop as "Boys Town" the group of young men trained for finishing all surfaces on the blade and forked connecting rods work at benches fitted with sheet metal guards and exhaust systems



To speed the inspection of finished Allison crankshafts, Cadillac tool engineers have developed stepped gages for setting dial indicators employed in the two inspection operations shown above. The inspector first sets his dial gage against the stepped gage and then moves the dial gage over to check a designated service on the crankshaft. For longitudinal dimensions, the crankshafts are placed in a vertical position, while for other inspections the crankshafts are held horizontally between accurately adjusted rolls

ployed in building the Cadillac chassis are of use in the production of combat vehicles. They have been moved out to make room for the new equipment needed for this work.

Several modified Cadillac automotive engines are used to power the combat vehicle being made by Cadillac, and only a few changes were necessary in the engine machining group to get into production on the revised engines. In other sections of the car division, however, machine tools have been moved out wholesale to make space for other machines being brought in to make combat vehicle parts and to provide room for the assembly and inspection of these vehicles.

Despite the fact that a large number of new employees have had to be trained quickly, scrap is being held to an average of three percent, or close to the level for automotive operations. Wherever possible conveyor lines have been installed for moving parts. Jigs and fixtures have been made as foolproof as possible so that new operators could be trained quickly. A parts "float" is maintained so that all machines can be used 24 hr. a day. If machines are not busy all the time on one job, they are provided with two sets of tools to permit their use on two or more operations.

Gages Inspected Frequently

Gages for parts with limits of 0.001 in. or less are checked against masters at least once a day. Those used to check dimensions with limits from 0.001 to 0.003 in. are tested every other day. If the limits range from 0.003 to 0.005 in., the check is made once a week. For limits above 0.005 in. the check is made every two weeks. Electrolimit and other comparator type gages are checked every shift. These special gages are employed in the shop and in inspection departments for all inside and outside diameters where close tolerances apply.

There is no back-tracking of materials. Where conveyor lines cannot be installed conveniently, rack-type trucks haul parts from operation to operation.

Cadillac has given careful attention to training employees for Allison work. Every surface on Allison crankshafts and connecting rods, for instance, must be finished by machining and then polished by hand to eliminate all machining marks and to remove all burrs and sharp corners. A large group of young men has been trained to work to the close limits required.

Among Cadillac's training projects is one involving women, who now are taking over certain operations in polishing and hand finishing. As selective service digs into Cadillac's forces, more and more women will be employed. The company's experience with women workers has been very satisfactory.

Develops Improved Tooling to Obtain Greater War Output at Lower Cost

EACH OF THE VARIOUS plants operated by the Chevrolet Motor Division, General Motors Corporation, now is turning out weapons and other equipment for the armies of the United States. These range from guns and combat cars to aircraft engines. Most important of these activities is the manufacture of a double-row radial aircraft engine for which practically all of the company's plants are producing parts, and for which one entire plant has been converted for final assembly and testing operations, in addition to the manufacture of a few of the larger parts.

The problem of converting plant facilities, revising existing machine tools and purchasing new units, and the development of jigs and fixtures for manufacturing these engines has not been easy to solve—since changes in the requirements of our air forces have made it necessary to double the original program, and then redouble it. When that is done entire production lines must be revised, new machines must be ordered, and in many cases entirely different methods must be adopted in order to produce at maximum efficiency. Even though all these changes have been necessary, Chevrolet already is ahead of schedule in the production of these units.

Only five years old, Chevrolet's engine and axle plant was one of the most modern producers of automobile engines in the industry when orders came to change it over to the manufacture of aircraft engines. All of the equipment was practically new, and in good condition. Yet only about ten percent of the machines in that plant could be converted for use on aircraft engine parts, and only 80 percent could be transferred to other plants for other war work. The remaining ten percent, consisting of the highly special multistation drilling, reaming and tapping machines, the huge surface broaching machines and the other special units originally developed for specific operations on specific parts, have no place in the war production program and have been moved out to make room for new units.

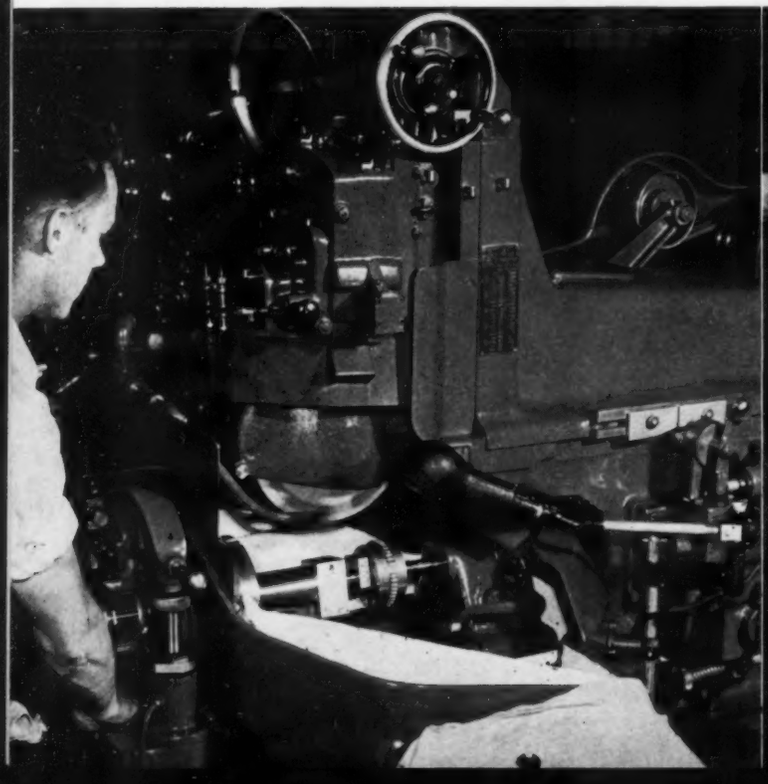
Most of the machines in this plant that could be put to use on the parts to be made there were standard millers, grinders and drill presses that only had to be retooled for their new assignments. A few grinders originally set up to grind camshafts and crankshafts have been converted by replacing the original headstocks and tailstocks with other units having capacity for aircraft engine parts, but this was only a matter of buying and mounting these units. Several huge vertical multiple-spindle drills were returned to the maker's plant where new geared spindle heads were installed. Probably the major conversion of equipment in this plant consisted of changing over a large conveyor-type furnace originally installed to heat-treat axle shafts. This unit now hardens, quenches and draws steel cylinder barrels in an automatic cycle.

It is in the other Chevrolet plants that the major conversions of machine tool equipment have been found possible. In one gear and axle plant, for example, front and rear axle assemblies are being produced in large quantities on virtually the same equipment used

Limited production quantities under the original contract dictated the installation of turret lathes for turning forged gear blanks

Three-fourths of the machine tools and much of the mechanized handling equipment (including overhead conveyors and bench-high conveyorized assembly lines) used to make axles for passenger cars and trucks during peacetime in this Chevrolet plant have been converted to the production of front and rear axles for four-wheel-drive Army trucks

Formed-wheel and generating-type gear grinders are used extensively. Here a Pratt & Whitney machine of the latter type is grinding the large gear on the magneto, oil and fuel pump drive assembly



Hand plug gaging is essential with the type of Heald internal grinder shown set up for the supercharger impeller gear. Automatic hole grinders from the auto plant lines have been tooled up for some aircraft gears

to make truck and passenger car axles in peacetime. Differences in design of the peacetime and wartime products of this plant naturally have made necessary a large number of changes in the production equipment. Yet more than 75 percent of the machines have been transferred to the manufacture of ordnance materiel. In some cases this has meant only changing the tooling on the machines to accommodate a larger part on which different surfaces must be machined. Many of these machines, however, have been completely rebuilt —either to make them suitable for entirely different operations, or to increase their rigidity, provide different speeds and feeds, or increase their capacity so they would be suitable for larger, though similar, parts.

With the conversion of this plant to war production came a complete rearrangement of production facilities in order to set up new manufacturing and assembly lines for truck axles. Some 3½ miles of conveyor equipment was torn out, some to be junked but most of it to be repositioned for the new operations. Expanded metal guards under some of the peacetime overhead conveyors have gone up again under the new installations—however, fewer lengths were needed in the new set-up and the surplus lengths have been used to build walls for stockrooms and tool cribs.

The Chevrolet department set up to machine high explosive shell bodies is a thorough study in conversion. Practically every machine assigned to this activity has been drawn from a peacetime job on some part for a Chevrolet automobile, and retooled for its shell operation. And almost every operator of these machines has come from an automobile production line. This shell line is one of the few in this country set up to finish the shell cavities by boring. Chevrolet production engineers have found that it is cheaper in the long run to permit more wear on the upsetter punches used to forge the shell, and then bore all of the cavities, than to hold the dimensions necessary in finish-forged cavities by replacing the punches as soon as they have worn beyond the specified tolerance.

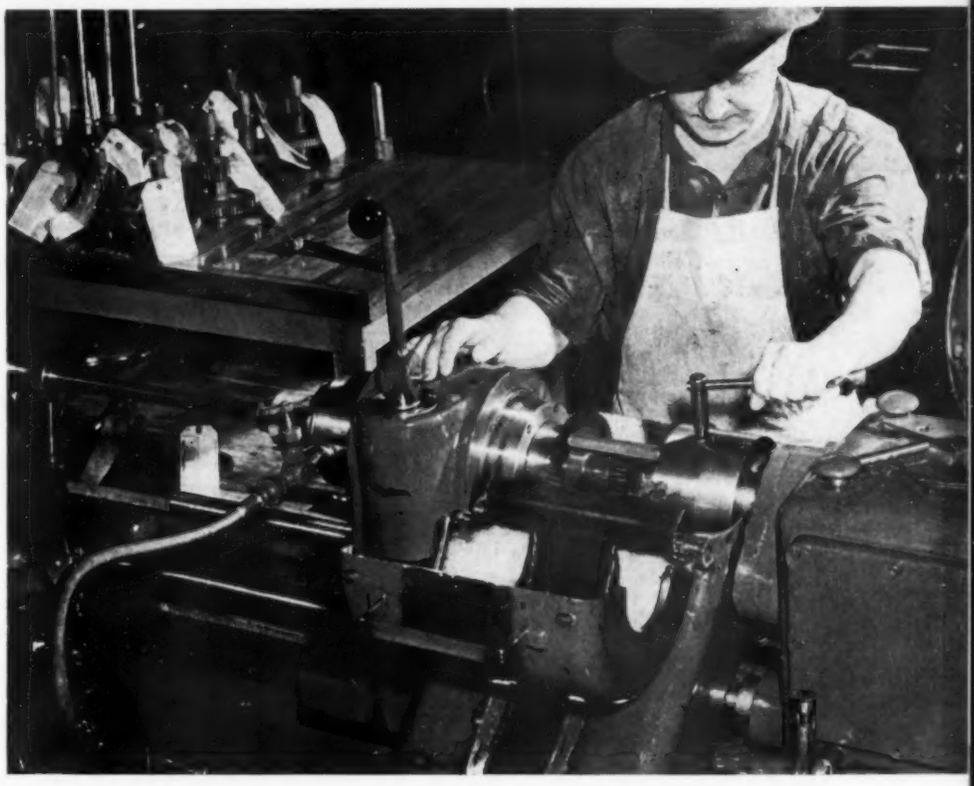
Four chief problems confronted Chevrolet's transmission plant in respect to its assignment to produce thirteen different aircraft-engine gears for the units being assembled at the engine and axle plant. These were: (1) equipment, (2) "double machining," (3) concentricity, and (4) finish.

Under the original contract, aircraft-engine gear quotas were insignificant as compared to the output of passenger-car and truck transmissions. It was impractical, and sometimes impossible, to make set-up changes on mass-production turning and hole-grinding equipment. After many hours or even days spent on the changeover, and at great expense for the type of tooling involved, a week's requirements for the aircraft gear could be produced in an hour or so. Manufacturing economics dictated the purchase of turret lathes and universal internal grinders lacking automatic hole-sizing features.

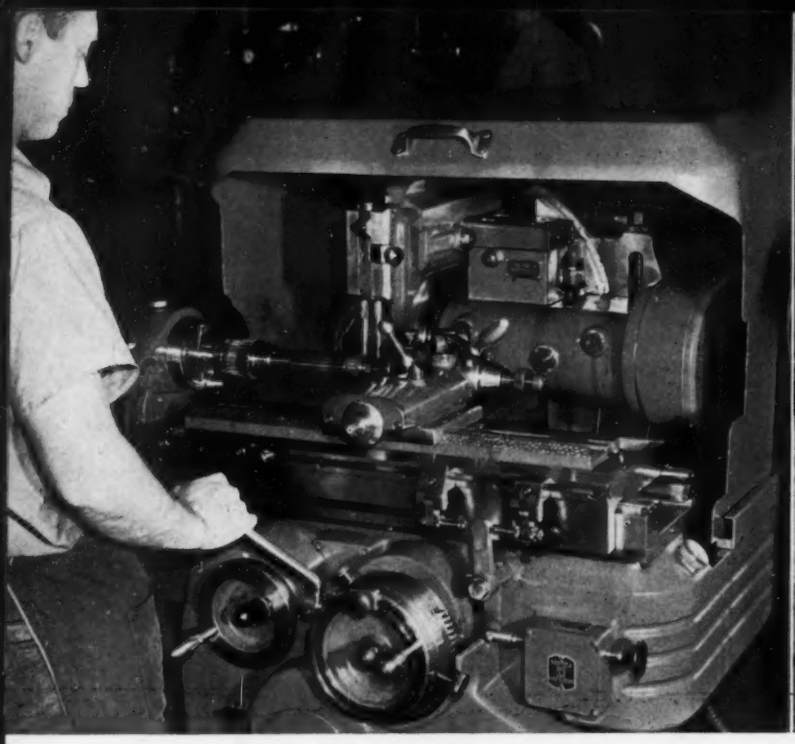
Some operations on aircraft-engine gears have no counterpart in commercial gear practice. Long holes, for example through an integral gear and shaft for the supercharger impeller, must be gun drilled to attain concentricity with pitch line or outside diameter dimensions. Specifications for aircraft-engine gears require grinding the teeth wherever possible, whereas gear-tooth grinding was eliminated years ago by auto plants. The only exceptions to this rule are cluster gears in which spacing causes interference with the grinding wheel. Ground gears without defects are accepted without lapping. This lapping process is reserved for cluster gears and for salvage purposes. Gun drilling, gear grinding and thread grinding required purchase of an important number of new machine tools.

The actual cutting of gear teeth is carried out on auto-plant gear shapers and gear hobbers, except that multiple-head equipment is not adaptable to the quantities involved. Hobbers are used whenever possible because hob life is greater than shaper-cutter life, and the latter are practically impossible to obtain. External and internal grinders from auto-plant lines are being changed over to aircraft engine work now that war work quotas have soared.

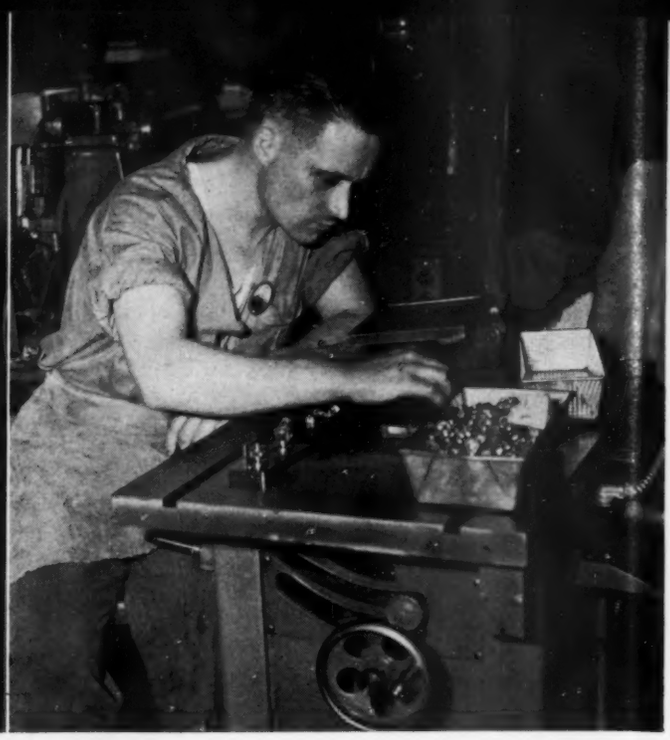
Inspection equipment would be an insuperable bottleneck, were it not for the fact that Chevrolet possessed a large and well-equipped gear laboratory. Under present conditions the laboratory has become a production inspection department, because the auto-plant spe-



As one of the last operations on the blower gear, a blind hole approximately 1⅛ in. in diameter and 4-in. deep is produced concentric with the machined outside diameter by a W. F. & John Barnes gun drilling machine



Short threads from approximately 1 to 5 in. pitch diameter are specified on a number of aircraft-engine gears. Here an Ex-Cell-O is grinding a 1 11/16 in.–20 NS fine thread at the end of the supercharger-impeller shaft



To remove the burrs in the slots of castellated nuts for aircraft engines, the operator guides the piece over a grinding wheel mounted on the spindle of a Walker-Turner woodworking machine

cial-purpose checking equipment is not adaptable to the new line of work.

Heat-treating methods have been changed. Heat-treating of aircraft gears is done by batch carburizing in controlled-atmosphere pot furnaces. Auto gears were carburized, but in continuous-productions cycles without controlled atmosphere.

Having begun the manufacture of aircraft-engine gears without the benefit of quantities lending themselves to high-production methods and machinery, Chevrolet is forced to continue along the lines established. Its big increase in schedule did not come until after the automotive industry's surplus-machinery pool began to function, with the result that some equipment which Chevrolet could use to advantage had been sold. Strides are being made, however, in setting up production lines that will process similar parts, thereby achieving more satisfactory machine loading. The cam-reduction gear and the cam-reduction drive gear are so nearly alike, for example, that they are machined over the same equipment.

"Double machining" is something never encountered in an auto plant. With aircraft-engine gears it is necessary to machine the part all over before carburizing and again after hardening. Chevrolet has found it impractical to localize hardening to teeth and bearing surfaces through copper plating or some other method of preventing carbon penetration on areas that are not to be hardened. In the first machining cycle, bearings and gear teeth are ground to leave just enough stock for finish grinding, to attain uniform depth of case. After carburizing, teeth and bearings are reground, and the carburized case is removed from areas to be left soft.

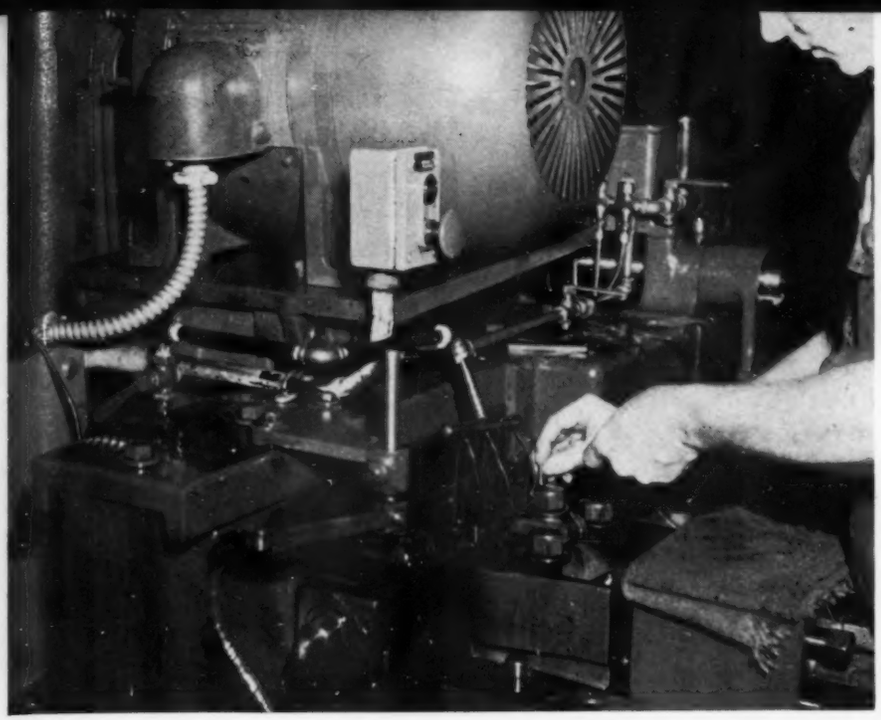
In automotive practice, the hole in a gear is usually drilled as one of the first operations, and is then used for location purposes in subsequent operations. But this is not true of aircraft-engine gear processing. The forging is centered, turned, the teeth are cut, the part ground and carburized and the hole put in as one of the last operations. To attain concentricity of the hole with the pitch diameter and bearing surfaces is quite a trick, and for this reason gun drilling is employed. Unfortunately, this process removes the centers, and introduces an element of uncertainty as to whether the bearing surfaces and teeth will clean up properly in the machining after hardening. Chevrolet plans to overcome this potential source of trouble by putting such large centers in the piece to start with, that gun drilling will not destroy the locating points.

Proper finish on aircraft engine gears calls for care in grinding, plus a large amount of hand labor to break sharp edges on gear teeth and at oil holes with abrasive wheels and points. Once production lines are completed and temporary tooling gives way to permanent fixtures, means will undoubtedly be found to reduce the amount of labor spent upon burr removal and polishing.

Although a mass producer of automobile and truck parts requiring a preponderant use of automatic screw machines and grinders, one Chevrolet plant discovered that not more than 15 percent of its equipment needs for small aircraft engine parts could be satisfied with existing machinery. Chief lacks were form grinders, thread rollers, thread grinders, precision boring and turning equipment.

Aircraft-engine parts assigned to this plant consist of such items as steel piston pins, nuts, studs, bolts, fuel-pump drive couplings, special locking rings, aluminum valve guides and piston pin plugs, and ground-thread brass couplings. Automatic screw machines were retooled for roughing many of these parts from bar stock, but new machinery was found essential for the many subsequent operations required to attain precision and to avoid or remove tool marks and scratches.

Nuts for aircraft engines offer examples of tooling problems encountered. Automobile plants are not often set up to make small nuts, buying them instead from specialists who work to commercial limits. Aircraft specifications on the other hand are such that Chevrolet was forced to make its own large requirements of these items.



Small studs are produced by thread rolling to a Class III fit on Waterbury-Farrel machines. Thread rolling dies must be exceptionally accurate to produce a starting thread and a main thread to proper tolerances and agreement in lead of threads

Like all bar stock consumed for aircraft-engine parts, material for these nuts passes through a series of inspections not found necessary in automotive practice. Before being placed in material storage, incoming bars are checked for hardness, then 100 percent inspected with a magnetic induction tester to detect flaws in the steel. Acceptable bars are next checked for tolerance on diameter, stamped with the lot number, given a visual inspection for surface defects, and painted with an identifying color. Samples are cut from each lot of bars and sent to the laboratory for physical and chemical checks.

Since no scratches or draw lines are permissible on the sides of hexagon nuts, the bar stock is purchased 0.004–.008 in. oversize to allow for grinding. All six sides of hex nuts are ground in three passes through a double-end Gardner No. 115 grinder. Nuts are placed on butttons on a dial plate, indexed by a stationary finger before the second and third passes through the machine, and finally kicked automatically into a pan.

The nuts are castellated upon a special auto-plant slotting machine that formerly performed the same operation on axle nuts, but the burr thrown up must be removed by grinding. As a convenient means of removing the burr in each slot, the nut is guided over a grinding wheel that replaces the saw in a Walker-Turner woodworking machine. Top and bottom surfaces of the nut are ground on a Blanchard surface grinder.

Studs and screws also presented equipment problems. Auto-plant form grinders were suited to tapers and large radii but did not possess the proper characteristics and dressing means to handle the forms on studs and screw blanks. Studs have a starting thread a few thousandths smaller than the main holding thread. The problem is to grind the various diameters on the blank to exceptionally close limits, because it has been found that even a few tenths variation will multiply itself several times in thread rolling to a Class III fit. Thread rolling dies are required to be exceptionally accurate because the starting thread and the main thread are rolled simultaneously and must agree in lead.

Thread gages are needed in large numbers to check aircraft studs. "Not go" and "go" gages are supplied for the starting thread and the main thread on each end of the stud. Similar gages are used by inspectors prior to plating and also after plating.

Finish is of great importance on aircraft engine parts. The steel counterweight rivet, for example, must have the recessed end free of tool marks, even though the edges will be turned over. The blank, as received from the automatic screw machine, is inserted in the collet of a Gisholt turret lathe, and about $\frac{1}{64}$ in. of stock is removed from the riveting surfaces with a special drill. This operation gives a fairly smooth surface, but Chevrolet plans to substitute precision boring in order to eliminate hand polishing.

High finish is required on the radiused button head of the aluminum piston-pin plug, even though it is not a stressed part. The shank of the plug is inserted in the collet of a Gisholt turret lathe. A form tool on the rear slide first radiuses the head, after which a special carbided-tipped shaving tool in the tailstock finishes the contour to a smooth reflective surface.

To lift output and promote economy on war production, Chevrolet will continue its efforts on a broad front to develop improved tooling and grinding methods, so as to minimize the need for hand polishing and buffing of aircraft-engine parts.

Automotive methods of rounding tooth edges have not been adapted so far to aircraft-engine gears. Tedius burring and corner rounding operations are performed with small abrasive wheels and points

War Work So Different That Both Supervisors and Workers Had to Be Retrained

MANUFACTURE OF passenger-car bodies differs so radically from armament projects assigned to certain units of the Fisher Body Division, General Motors Corporation, that existing buildings and manpower are often the major salvageable items. While such plants were being retooled, largely with new machinery, Fisher took advantage of the interval to retrain supervisory personnel.

The problems of retraining personnel are exemplified by several Fisher plants. In peacetime, these Fisher plants employed 55,000 workers and approximately 4,000 foremen on mass production and assembly of sheetmetal stampings, trim and upholstery. Only a small percentage of these people possessed any experience in the heavy machining of armament components, and none knew anything about armor-plate welding. Under the circumstances, Fisher was forced to tool up its plants so that a minimum amount of skill would be required.

At one plant, as an example, two types of foreman-training were undertaken: (1) a ten-week course in elementary machine-shop practice for 150 foremen at the General Motors Institute, plus in-plant training upon the arrival of new equipment, and (2) the training of 50 foremen as qualified armor-plate welders to enable them to properly supervise and inspect the work of their operators.

From this group of foremen taking elementary machine-shop practice at the Institute, nine qualified supervisors were selected and trained to act as instructors to assist in teaching the fundamentals of machine-shop practice to former body-shop foremen. At General Motors Institute the 42-hour instruction week was broken down as follows:

1. BLUEPRINT READING—4 hr. The objective of this course is to teach foremen how to read war-production blueprints, including assembly and sectional views.

2. PRECISION INSTRUMENTS—4 hr. Use of inside and outside micrometers, verniers, calipers, height gages, combination squares and scales is taught in this course.

3. SHOP THEORY—4 hr. Information that can be taught in a group is imparted in this period, such as types of machines and cutting tools, also feeds and speeds.

4. SHOP PRACTICE—16 hr. Instruction covers rudimentary operation of basic machine tools—the lathe, milling machine, shaper, drill press and grinder.

5. TRADE MATHEMATICS—4 hr. Fundamentals are reviewed, with special emphasis on fractions. Foremen not ordinarily engaged in machine-shop work frequently have difficulty with simple calculations.

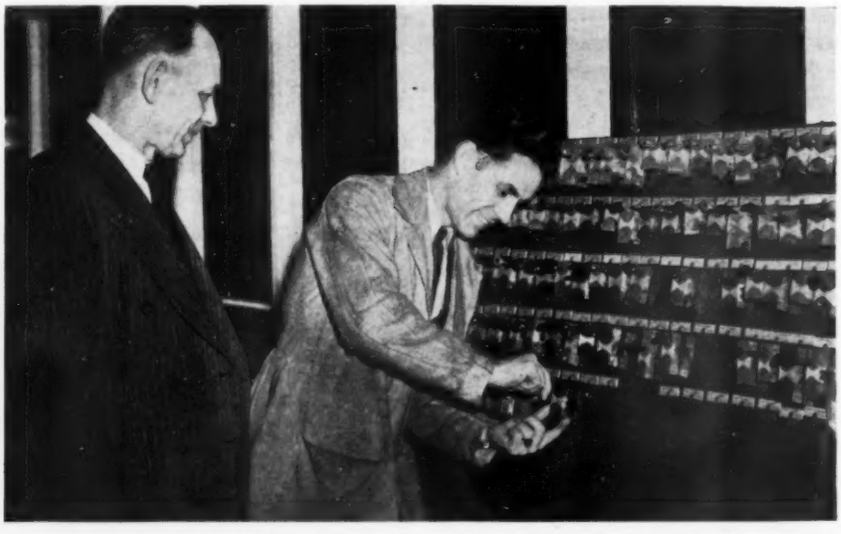
6. MATERIALS AND SPECIFICATIONS—4 hr. A brief outline is covered of characteristics and processing of materials, how to check materials, and how they were checked by vendors.

7. SELF EXPRESSION—4 hr. Instruction in preparation of written and oral reports, on the taking of notes, and development of the powers of observation.

8. GENERAL ASSEMBLY—2 hr. Management used this period to keep foremen abreast of over-all objectives and plans.

Upon completion of the ten-week course, these foremen were given from three to four weeks of in-plant instruction in operation of the specialized equipment required in manufacture of armament to be built in the plant. Each machine has a chart showing the part, the operation to be performed, locating points for the work, speeds and feeds, and dimensions to be gaged. The foreman should be able to set the machines under his jurisdiction, although so far as possible each machine will be tooled for a repetitive operation. Therefore, the foreman's chief task is to learn how to operate the machines under his control, train operators for his machines and see that production of satisfactory work is maintained.

Streamlined instruction of this



On the premise that foremen must be able to handle the job, in order to supervise operators, Fisher Body taught the art of armor-plate welding to a selected group, required them to pass the government's test. As each foreman qualified, his coupon was hung on a merit board

Shop foremen chosen for supervisory duties on armament machining were given a ten-weeks course in machine-shop fundamentals, then three or four weeks of on-the-job training during which they learned to set up and operate equipment under their jurisdiction

character puts to use the supervisory abilities of an experienced foreman, but does not take in too much territory because his sphere of activity will be limited by the policy of minimizing the number of machines for which he is responsible, and by providing tooling that will eliminate the need for all-around skill. From time to time, training films prepared by the U. S. Office of Education will be run to act as "refresher" courses, and of course, the management will provide such additional training as circumstances suggest.

Fisher's training program for personnel connected with armor-plate welding encompassed two distinct phases: (1) training welding foremen, and (2) aiding a state-operated welding school by furnishing equipment, material and instructors to train armor-plate welders.

Preceding the first step, the plant's welding specialist and a corps of assistants reviewed existing knowledge of armour-plate welding, engaged in comprehensive research, and developed production methods and jigs. This far-reaching and continuous program has cut much time from estimates for fabrication, applied automatic arc-welding processes, minimized distortion of assemblies, and reduced the necessity for machining tank structures after welding.

After developing the technique of armor-plate welding, the original group of a half-dozen supervisors undertook the training of approximately 50 foremen in the art. This training program was undertaken progressively. The first group of retrained foremen handled the building of the first experimental products, and the balance of the group took on the supervision of welding operators as the program gathered momentum. The in-training period for foremen varied widely, but seldom exceeded four weeks. Previous experience with arc welding had little bearing upon ability to weld armor-plate, except in regard to manual dexterity. Each foreman was required to pass the government's test for armor-plate welders upon the premise that only a qualified man is capable of completing the training of welding operators and of maintaining quality in production. Sample weld specimens were sent to the government inspectors for X-ray analysis and other tests, and if passed were hung on a bulletin board. This practice built morale and created a powerful incentive to make the grade quickly, quite apart from the necessity to hold one's job.

While the process of retraining foremen was going on, several qualified men selected from the group went to the General Motors Institute of Technology for a short training in the art of instruction, and then they were loaned to the state-operated school as instructors. The school, which is excellently equipped and operates on four six-hour shifts per day, has capacity for training more than 200 men.

The state pays for instruction, rent, light, and power costs incident to the Arc Welding School, with some of the equipment and material being furnished by Fisher Body. Applicants for training are accepted by the U. S. Employment Service from among employees of various motor plants in the area. Prior familiarity with the application of heat to metal—production welding, torch welding, body soldering—has a bearing upon acceptance.

Period of instruction ranges from two to four weeks, with 150 hr. about the average. Composition and thickness of metal, current values, method of making various beads, are matters that vary considerably from arc welding of mild steel. Learners work in pairs, one making a weld while the other watches. Mild steel scrap is employed at this stage, but later on trainees are given armor plate and alloy welding rod. The school does not release men for employment as armor plate welders until they have proved they know how to weld and are practically ready to take the government test for armor plate welders.

Trainees accepted by Fisher Body are placed on the payroll, and put in a a special final training department separate from production welding. Usually with a few hours of instruction, the trainee is able to pass the government armor-plate welding test. These tests are now made by Fisher Body, and test samples and data are filed in plant records.

Fisher Body also has the problem of selecting and training operators for general machine shop work. To select operators for these jobs, the company made a study of the job capabilities of its employees. A considerable number of shop personnel were found to have experience which would qualify them for rehiring immediately.

Gets Into Gun Production Rapidly By Subcontracting 462 Out of 471 Parts

FEW COMPANIES anywhere have done a better and more thorough job of subcontracting than has the Oldsmobile Division of General Motors Corporation. Of the 471 parts going into the assembly of three guns, 462 are being farmed out to more than 150 plants, both large and small, throughout the country. In many cases, a subcontractor makes parts for all three guns.

In lining up subcontractors, Oldsmobile first went to the plants that had been supplying automobile parts in peacetime. When these companies were filled up with orders, it sought out plants in other industries having metal-working equipment suitable for the parts to be made. For example some of the more important subcontracted parts for one of the aircraft-type cannon now are being produced by a manufacturer of sewing machines.

In letting subcontracts, Oldsmobile furnishes the material, most of the jigs, fixtures and gages, and all necessary manufacturing information. Each subcontractor is followed up at frequent intervals by field contact men who iron out difficulties and assist in training the production employees of subcontractors to keep both quality and quantity of the war products at a high level.

In converting from automotive to war production, Oldsmobile found that only about one-third of the machines needed to make its war goods could be transferred out of its automotive departments. Other equipment to make guns and shell had to be purchased from machine tool builders or secured from the automobile industry's equipment pool. Actually, very few machine tools normally used in making motor cars have the size and capacity for machining the larger gun parts.

In its shell division, Oldsmobile has been making high-explosive shell for more than a year and a half, being one of the first large contractors for these items to get into mass production. Because the shell lines were set up long before it was thought that there would be any need for curtailing automobile production, few of the machines now employed for making high-explosive shell were taken out of the automotive production departments. However, now that it has been necessary to increase production facilities on these shell, some large upsetters are being brought in from other automotive forge shops and put into the shell forging department.

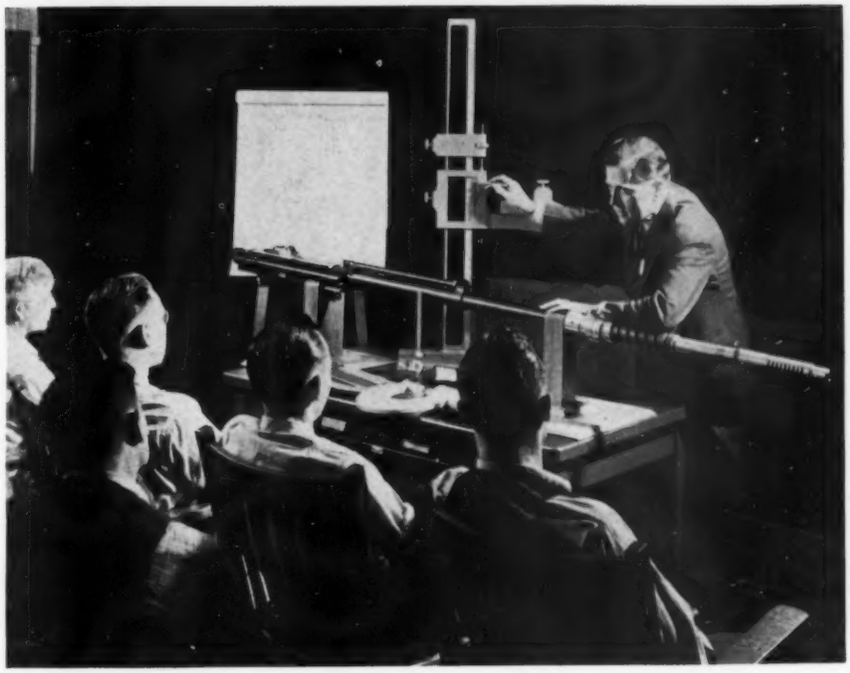
Likewise, when it became necessary to install equipment for heat-treating the high-explosive shell, the necessary furnace equipment was drawn from automotive production lines, since this change in manufacturing specifications came at a time when the conversion of the automobile industry was just getting under way. The efficiency of the heat-treating equipment of these shell has been increased materially by

More than 150 sub-contractors make 462 parts for the three guns being produced by Oldsmobile for our armed forces. Each of these subcontracted parts is checked carefully before shipping from the sub-contractors plants, then is given a 100 percent inspection upon receipt by Oldsmobile, before it is put into stores for assembly with other parts

inserting specially-developed automatic quenching units in line between the heat-treating and drawing furnaces, which are of the conveyor type.

Today, the company is rapidly setting up an entirely new shell department and a number of the machines required are being drawn directly from automotive machining lines. In the pilot line for one size of shot, for example, there are a number of LeBlond and Fay automatic lathes, and New Britain-Gridley automatic multiple-spindle chucking machines originally used for turning pistons. These machines have been retooled completely for the shell job, and have been set up alongside a roller conveyor line assembled from short conveyor sections withdrawn from a stock of these sections built up when the automotive lines were shut down. When the regular production lines for these shot are in operation, they will include a large number of centerless grinders, drill presses, milling machines, piston lathes and heat-treating furnaces withdrawn from automotive lines, rebuilt and retooled to make them suitable for war production operations.

Oldsmobile received a letter of intent from the government more than a year ago on a contract to make a certain aircraft cannon. The company was asked to produce the first weapon

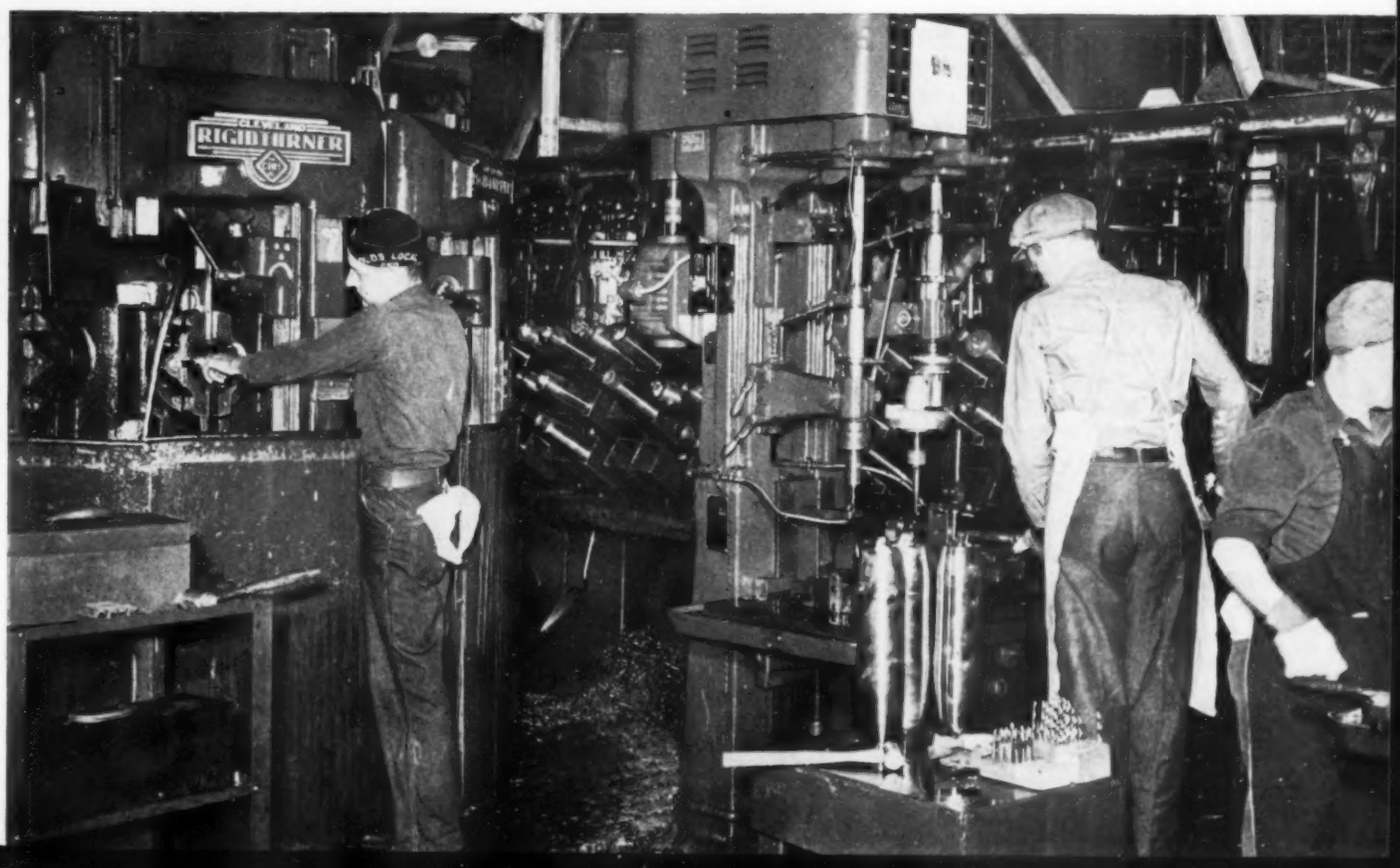


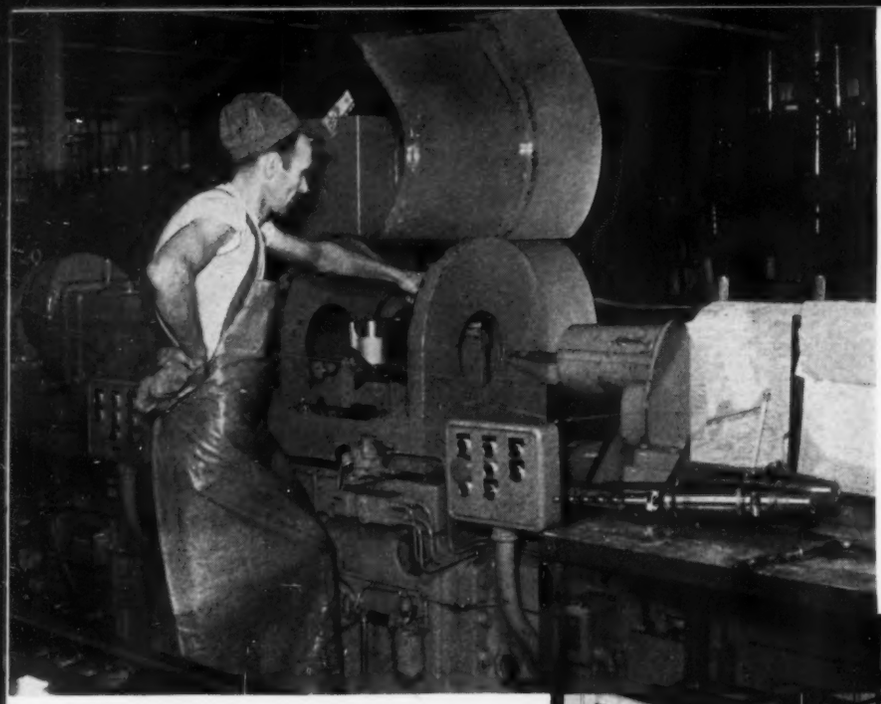
Manufacturing tolerances and part shapes and sizes on guns are in no way comparable with those of automobile parts. Therefore, it has been necessary to install special training courses for supervisors and inspectors, and to use the two-for-one system of training machine operators

30 days after delivery of its last machine tool. Actually, it produced the first unit several months before delivery of this last machine. Since then, daily output has risen to a point considerably higher than the maximum fixed in the original schedule.

All the company had at the start was a roll of blueprints, an idea, and a determination to do something. Labor, management and the automobile industry's sub-contractors cooperated admirably, and by the middle of the summer in 1941 parts began to flow in from sub-contractors. Early that fall, the first pilot units of the three major parts made by Oldsmobile itself were produced. Soon afterwards, the first completed guns came off a pilot line and by the first of this year the plant

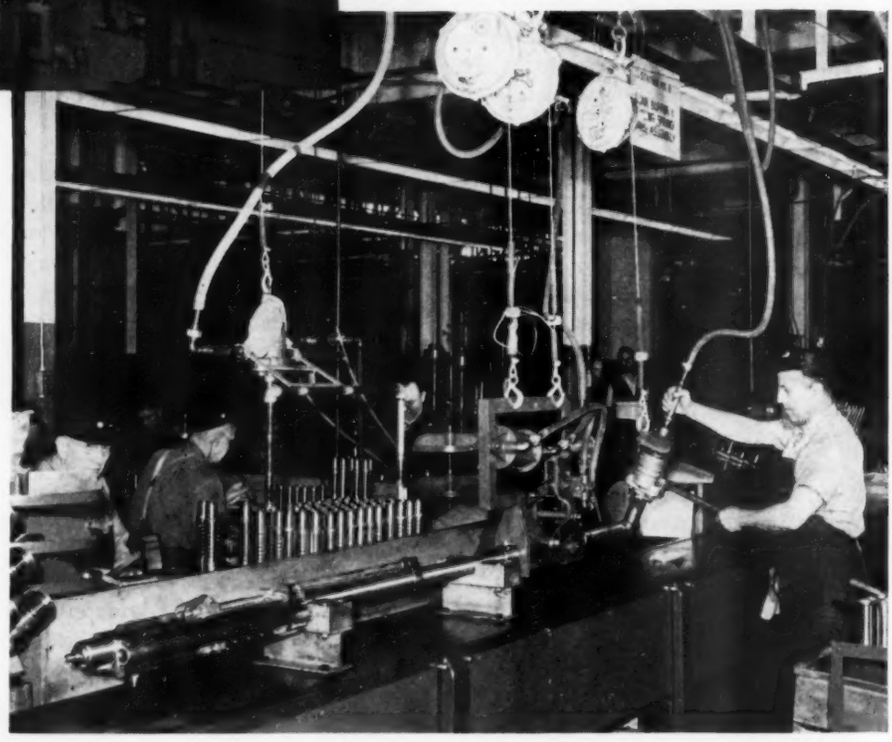
No other shell machining plant in the country has gone so far in adapting automotive line-production methods to shell manufacture as has Oldsmobile. Conveyor lines carry the shell bodies from station to station down the machining line in this plant. Carbide-tipped tools are used wherever practical





This two-way Natco drilling machine, has been retooled for drilling and reaming locating holes on each side of the breech block. These holes serve to locate the block in fixtures in each of the succeeding machining operations, so as to insure accuracy

Oldsmobile has gone to the automobile assembly line for inspiration in setting up assembly groups on each of the three sizes of guns it is manufacturing. Slat-type conveyors carry support blocks to position each assembly. Power-operated wrenches and clamps speed the work. Sub-assemblies are put together at benches beside the assembly line



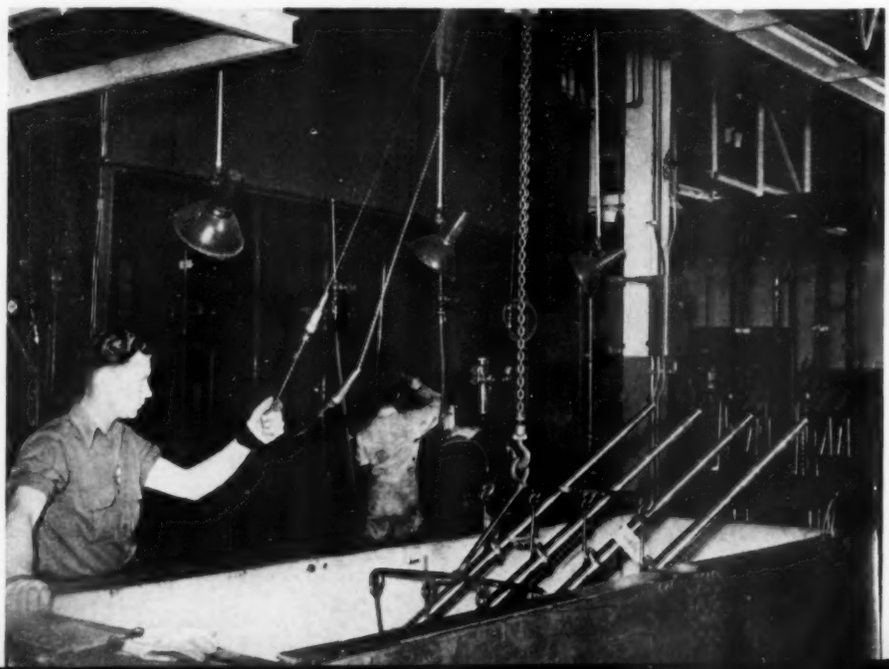
was producing at a maximum rate scheduled under the original contract. Today, a little more than one year from the date of the letter of intent, shipments have been completed on the original contract, and work on the following contract is well under way.

The division's plants are operating on an all-out war production basis, 24 hours a day, seven days a week. Employment has already passed all previous automobile production peaks and is still mounting. All former automobile workers have been retained for precision war work under a "two-for-one" program in which machines now in use are double-manned. Each operator has a trainee assigned to him. The trainee learns, goes on to a machine of his own, and another trainee comes in.

In addition, Oldsmobile is training a number of Army and Navy service men who will keep the guns in operating condition in the field. These men spend about three weeks at the plant observing all manufacturing operations and taking part in firing tests so that they may be thoroughly familiar with the production and operation of the unit they later will service.

Already, the company is giving serious consideration to the possibility of employing women for many of the operations on gun parts, as is already the case in Canada and in England. Up to now the labor supply has been ample, the company having called back to work all of its entire automotive production force within a short time after automobile production work stopped. Also, it has been able to draw on the labor force formerly employed by another automotive plant in

After the assembled guns have been proof fired, they are returned to the assembly department and torn down, cleaned, inspected and reassembled. Here, four gun barrels are being removed from a dip-type degreaser. In the background is shown the water-curtain type paint spray booth



the same district which will not require all of its production workers when it finishes a complete retooling program for war production and gets back into operation again. However, a number of the younger men are being called by selective service for work on the firing line instead of the production line, and it soon may be necessary to tap new sources for workers.

Supervisors in the gun division have been drawn from the supervisory staffs of the old automobile production departments. These supervisors work six days out of every seven, on an eight-hour day, three-shift basis. On the other hand, hourly employees work five days out of every seven, with rotation within the shift on a seven week cycle, so that each man gets some Saturdays and Sundays off during the seven weeks. Each hourly employee is off 14 days in the seven-week cycle, two of the 14 days being Sundays. In addition, there are two, three-day weekends in each seven-week cycle. Five out of seven men on each shift are at work each day of the week, so that the plant is operating a full 168 hr. week. Shifts are rotated anti-clockwise every four weeks so that each hourly worker spends the same amount of time on each of the three shifts in a twelve-week period. To simplify his schedule, each workman is given a card showing the days that he is to work in any week during a six months period.

Naturally, the load on the production engineering department has been tremendous in getting set up for a complete change in manufacturing procedures, such as has been the experience at Oldsmobile. First, it has been necessary to set up temporary pilot lines for each of the three guns in order to finally prove recommended layouts and fixture designs, and to get production started at the earliest possible date. These pilot lines are made up, in so far as possible, of standard machines, or special machines taken from the automobile production lines and retooled for single operations. Recognizing that these units are not efficient on the heavier gun operations, they are removed from the gun division and returned to the machine tool pool just as soon as more efficient machines can be obtained.

By setting up a special tool and fixture maintenance division in the production engineering department, Oldsmobile is giving special attention to problem operations, and is ironing out the difficulties in these operations, while the planning and tool design divisions remained at work on the rest of the program. By applying automotive "know how" to these gun production problems, it has been possible to reduce production time materially on all three sizes being made. In the case of one gun, requirements for machine tools have been reduced to one-third of the total that would have been necessary if methods and tools employed elsewhere had been adopted.

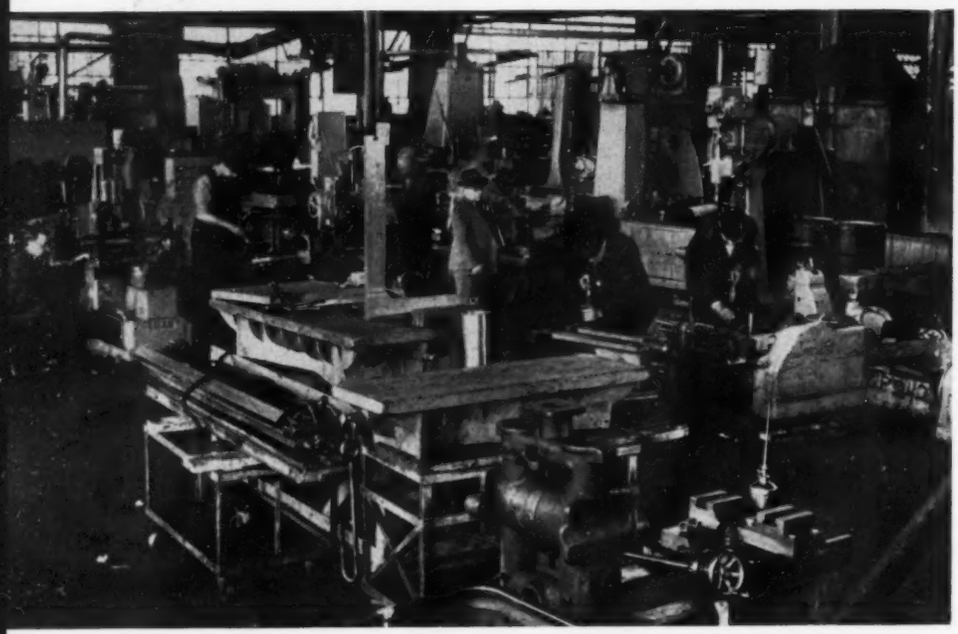
The war will be won with weapons built this year ..... DONALD NELSON
EVERY DAY !
EVERY HOUR !
EVERY MINUTE COUNTS!
Only 253 Days
REMAIN IN THIS YEAR
TO DO THE JOB !
KEEP 'EM FIRING !

Important in Oldsmobile's program to stimulate war production, this sign reminds supervisors and hourly employees that every minute counts on the production line if we are to win the war on the firing line

Of particular interest to all industries involved in the war production problem is the so-called "Keep 'Em Firing" campaign developed at Oldsmobile to stimulate war production. When, in December of 1941, Olds mobile's job of munitions manufacture changed from one of defense production to war production, it was immediately apparent that new measures would have to be taken to speed the output of cannon and shell. Oldsmobile immediately started to work on a special program of activities designed to inspire the cooperation of all workers and management alike. From the beginning, this program has been applied to all of Oldsmobile's plants and to those of Oldsmobile's sub-contractors.

Basically, the "Keep 'Em Firing" campaign embraces a number of items, each designed to play its part in keeping production effort at a high level. These are: (1) A production scoreboard on which daily records are posted as a stimulant to greater accomplishment; (2) specially designed posters put up throughout the plants on 403 permanent display panels and changed frequently; (3) a new plant publication issued monthly and mailed to the homes of all Oldsmobile employees; (4) billboard posters and bulletins throughout the city, as well as newspaper and national advertising campaigns telling of the "Keep 'Em Firing" program; (5) window display cards for retail stores and home window and car windshield stickers for individual display; and (6) celluloid campaign buttons for general distribution and insignia pins for employees to serve as badges of honor for those engaged in the all-out effort. In addition, a slogan contest for Oldsmobile employees was inaugurated, with prizes of defense bonds for the best slogans based on the "Greater Production" idea. To carry out this program with sub-contractors, Oldsmobile employs special contact men who devote their full time to calling at the subcontracting plant and setting up the campaign, just as it operates in the Oldsmobile plants.

Cannon Mass Produced Ahead of Schedule Brings in More Navy Contracts



More than 600 auto-plant machine tools will pass through the Pontiac machine repair department as part of the retooling effort for diesel engine parts, guns, torpedoes. Approximately 115 men are at work scraping ways, fitting bearings, changing cams, slides, feeds, speeds and machine cycles

FOR MONTHS prior to Pearl Harbor, the management of the Pontiac Motor Division spent a large share of its time examining armament projects that might be taken on a prime or subcontracting basis. Technical reasons, largely having to do with lack of suitable equipment, stood in the way of acceptance of these projects. But early in 1941 Pontiac secured a Navy contract to make cannon in mass-production quantities. So few motor-plant machine tools were found adaptable to gun work, that Pontiac tooled up an existing structure mostly with new equipment.

The record established in producing these cannon ahead of schedule, and of making a number of important improvements in the gun itself, brought the company additional Navy contracts shortly after the outbreak of war. The nature of these operations is such as to require a large percentage of new equipment, regardless of complete cessation of motor-car production and access to the automotive industry's pool of surplus equipment. Space in the service parts plant and in the car shipping department was cleared out for a part of these new Navy assignments, and a portion of a new building is also being used.

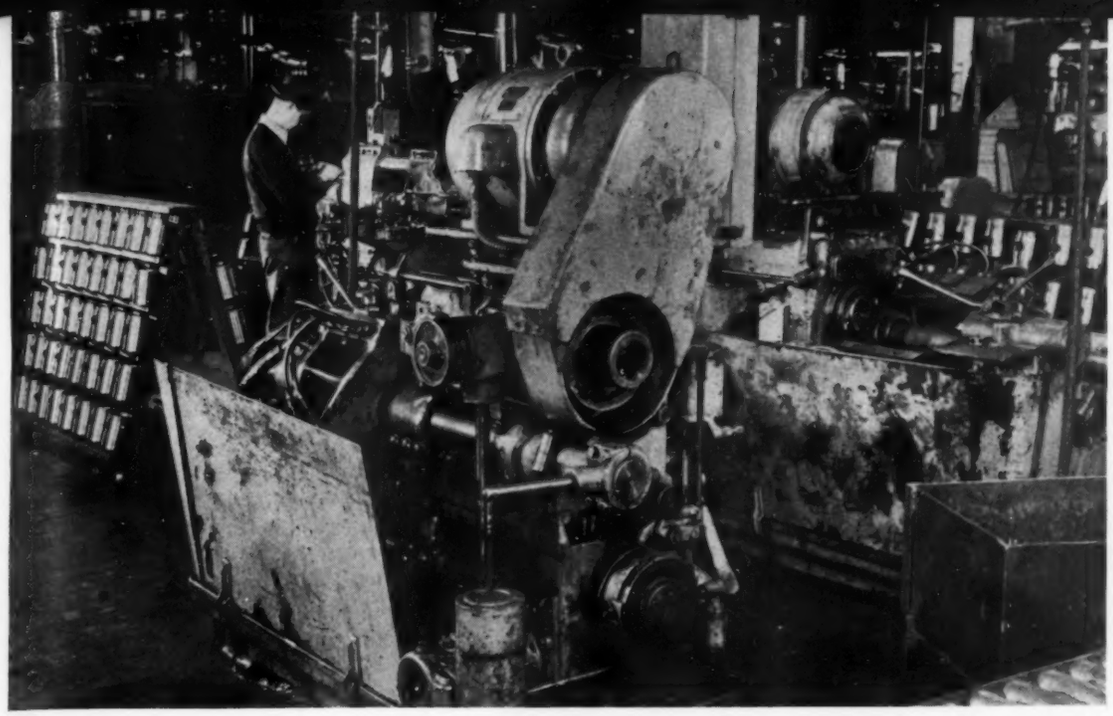
Increased war assignments to General Motors provided Pontiac with opportunities to utilize the remainder of its plant on subcontracts. The foundry is pouring a large number of truck-engine blocks per day. Tank axles will be made in the axle department. And the motor plant has been almost completely cleaned out and rearranged to make diesel-engine parts.

On the whole, Pontiac will be able to employ a large percent of its auto-plant equipment on war contracts already undertaken. Employment will be notably higher than the 1941 average.

The main problem faced by the management has been that of creating adequate supervision for four manufacturing divisions. Pontiac's managerial, engineering, master mechanic's, production standards, production-supervisory and toolroom staffs were spread thinly to cope with the manufacture of over 300,000 automobiles in 1941 and to carry out the cannon production assignment successfully. And there was little slack to be taken up in these groups when the call came to handle a second cannon, another Navy weapon, tank axles, diesel engine parts. Holes in the organization charts for these activities were plugged by extensive upgrading of persons with some experience in the plant. For example, assistant master mechanics and process engineers were made divisional master mechanics, tool designers stepped into the shoes of engineers, toolmakers became foremen.

At first glance it might appear that the problem of retooling Pontiac's motor plant for production of some 300 diesel-engine parts is one of the less difficult war assignments in the automotive industry. Fact of the matter is that the job is sufficiently different to require a major retooling effort of several months' duration. Numerous war-time applications of engines from one to six cylinders bring about a demand for many variations of a single part—such as 22 styles of flywheel housings. Diesel-engine parts are larger than passenger-car engine components. Monthly production quotas are a fraction of former passenger-car engine output, but employment will be higher.

Pontiac received diesel-parts machining equipment from another General Motors subsidiary, was required to train labor to operate that equipment, then to retool auto-plant machinery to achieve an output seven times that of the original plant. Few components, except pistons, camshafts,



To increase production capacity on finish turning the diesel piston, two Fay 12-in. automatic lathes from the motor plant are being added to the Sundstrand (in front of operator) which was obtained from the original diesel manufacturer

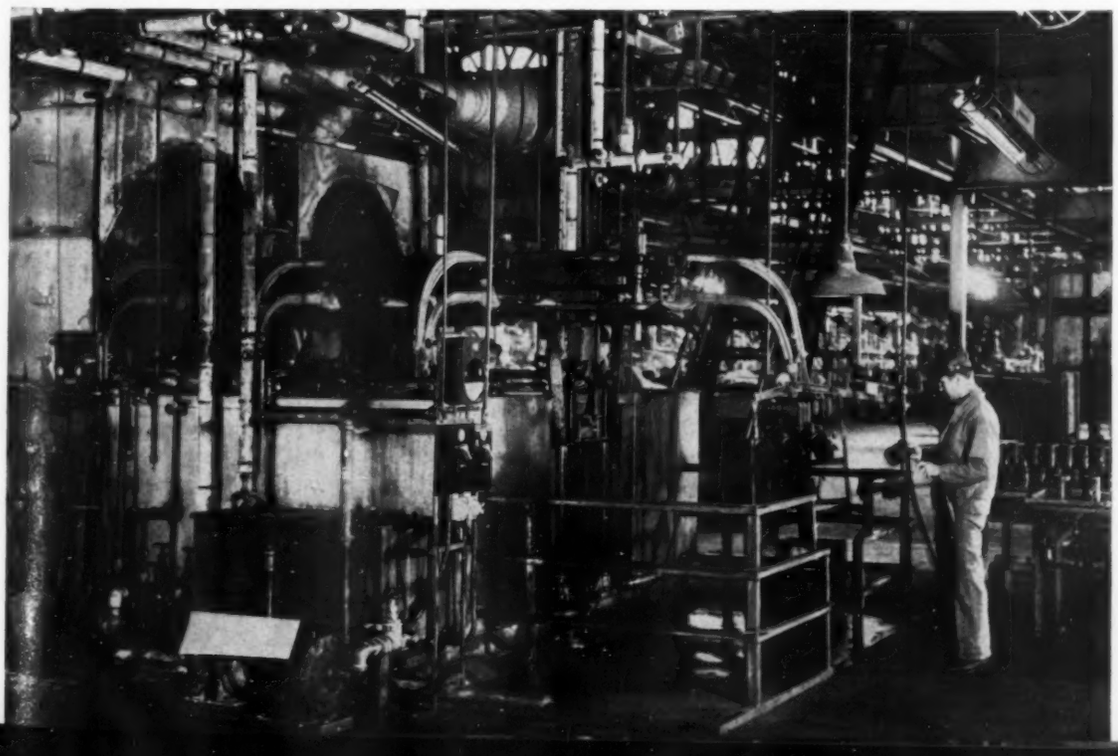
crankshafts and cylinder liners, are made on single-purpose machines.

Two miscellaneous parts departments cope with 78 and 54 pieces, respectively. Parts range from small forgings weighing a few ounces to odd-shaped castings tipping the scale at many pounds. To process material of such divergent nature over a line of a score of standard machines—radial drills, upright drills, adjustable-center multiple-spindle drills, knee-type millers—calls for endles revision of flow charts. The master mechanic employs a crew of trouble shooters to find the bottlenecks in the line. One machine is perhaps working at capacity, others have 30 to 70 percent loading.

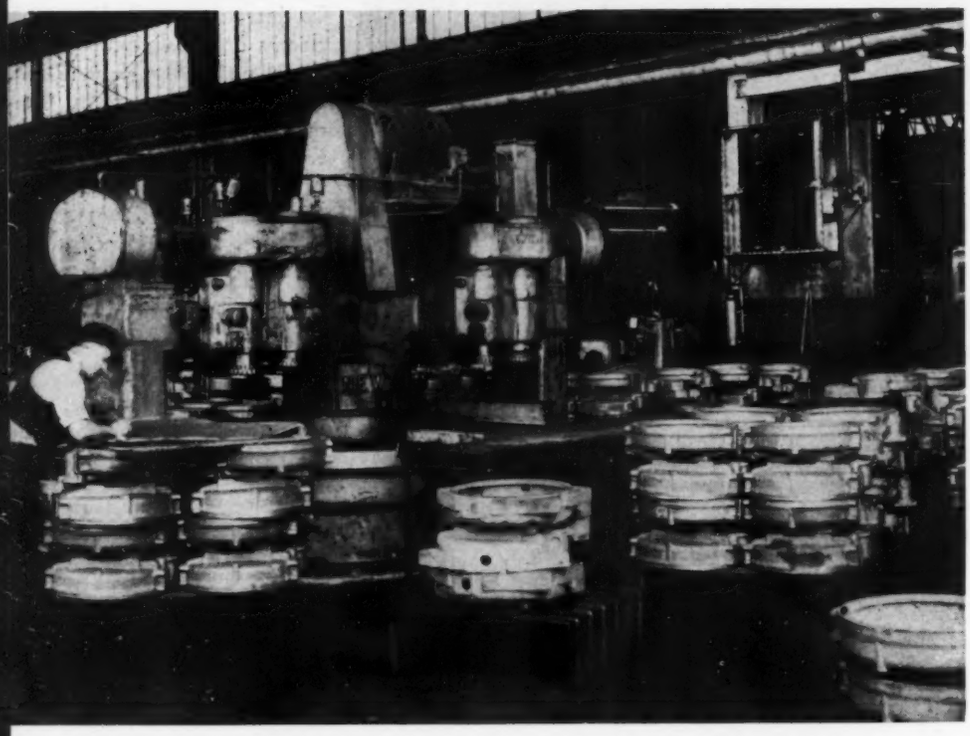
First problem is to raise output of the bottleneck machine, if possible, by feed and speed changes, better fixtures, new tooling, or application of carbides. New parts are added to the department load to take up idle machine time on equipment not fully employed. Further investigation shows where operations can be consolidated, thereby changing the flow sheet once more. There are literally a thousand and one things that can be done to increase efficiency of such miscellaneous-parts departments, and the trick is not to add machines but rather to improve methods. But in so doing, the master mechanic must grapple with countless details.

To achieve a seven-fold increase in production of diesel-engine parts as compared to the original producer, Pontiac must supply a 100 percent increase in machines and tools over the amount of equipment obtained from the former manufacturer. The tooling program involves rebuilding at least 300 auto-plant machines. Rebuilding time varies between 400 to 1,000 man-hours per machine and sometimes more. Like every other automobile plant, Pontiac overhauls machines at the model-change period, provides periodic maintenance as well. But regardless of the fact that the tool is in good condition for the auto set-up, rebuilding is essential to cope with diesel jobs. For example, during prior auto production, machine slides operated on fixed movements, causing localized wear of the ways. New set-ups may call for a stroke several times longer. To avoid inaccuracies on diesel parts, the machine ways and slides must be refitted. Larger parts and harder materials require new speeds and feeds, new fixtures, new tooling, perhaps new cams and feed slides.

Pontiac has found that rebuilding



To avoid tin plating for prevention of scoring, diesel pistons are chemically treated by the Lubrite process with equipment that formerly Granodized valve lifters for automobile engines



A Newton four-head mill that once machined cylinder heads takes its place in the diesel flywheel-housing line to face the castings faster than possible by the grinding method

of machine tools by the maker costs approximately 50 to 75 percent of the original price, and the job takes as long as building a new machine adapted to the work. Little success has attended efforts to get machines rebuilt by outside sources other than the maker, for the reason that such concerns lack drawings of the machine and machine-tool building knowledge. Fortunately Pontiac possesses one of the best-manned and equipped machine repair departments in the General Motors group of plants. Thirty out of 115 men working three shifts are highly skilled mechanics with twelve to sixteen years of experience in the department. Besides knowing how to rebuild machine tools properly, these mechanics have received special instruction at General Motors Institute in such subjects as hydraulic and electrical controls, thereby minimizing dependence for such work upon outside specialists.

The Pontiac motor plant offers some interesting comparisons of equipment chosen for certain operations by the original diesel manufacturer and the retooled auto-plant machinery which will provide the required boost in production. For rough and finish turning of pistons, Sundstrand lathes were purchased in peacetime for the original set-up. Pontiac had none of these machines available, but has utilized 12-in. Fay automatic lathes equipped with new tool arms and tools.

Motor-car valve lifters were Granodized in a large chemical treatment machine, the parts conveyor being timed to dip the work into chemical baths and rinse tanks according to an automatic cycle, and then to return the valve lifters to the loading and unloading station. Diesel-engine pistons were formerly tin-plated elsewhere to prevent scoring. To avoid the use of tin and to achieve the first mass-production application of the Lubriting process to diesel pistons, Pontiac spent 500 man-hours of work upon changing over the former Granodizing equipment. The tanks were cleaned out, new heating coils installed, solutions were changed, the cycle reset and new parts hangers provided for the conveyor. Productivity of this machine is far greater than anticipated needs, but the application proves both critical materials and the specification of new machinery can be avoided through the exercise of ingenuity.

Cylinder-liner centering equipment obtained from the original diesel-parts manufacturer consists of a small home-made single-end machine with hand feed and a new double-end machine with automatic feed. To increase production capacity of the cylinder-liner department, Pontiac has retooled a considerably larger, double-end Baker machine that formerly bored and tapped the motor-car differential carrier. The fixture is similar to that employed on the new machine, in that an air cylinder opens and closes the jaws. When the work piece is in position, the machine starting button is tripped and the two opposed spindles advance to center the piece, then return and stop. Because of extreme overhang, spindles run in heavy outboard bearings that are part of the fixture.

To provide additional capacity for boring the cylinder liner, Pontiac has retooled a Footburt vertical machine that formerly rough bored the six-cylinder motor block. The liner presented problems in machine rebuilding and fixture design because its bore is approximately 4¼ in. in diameter by 11 in. long. Diameter of the part limited the machine to boring three pieces at once. Hence every other one of the original six spindles was removed. Height of the piece is such that clearance under the cutters is approximately ⅛ in. To get work into and out of the fixture, it was necessary to provide trunnion bearings at the bottom of the fixture and an air cylinder to swing it out from under the cutters for unloading and reloading and then back against stops on the machine column. Each of the three workpieces is located and clamped in the fixture by double opposed collets operated by a handcranked worm and gear.

To save time in facing 22 different flywheel housings, a Newton four-head mill that formerly machined cylinder heads has been placed in the line. Originally the facing operation on flywheel housings was done by grinding, stock removal being from ⅛ to ¼ in. Two cutter spindles are located in each head of the mill, one for roughing and the other for finishing. Two operators will handle the machine. Fixtures designed for this operation will have cams to move the work toward and away from the center axis of the machine so that all portions of the irregular face on the housing are milled in one set-up.

Motor Cars to Munitions — **HUDSON**

Extensive Training Courses Convert Auto Workers to Fuselage Production

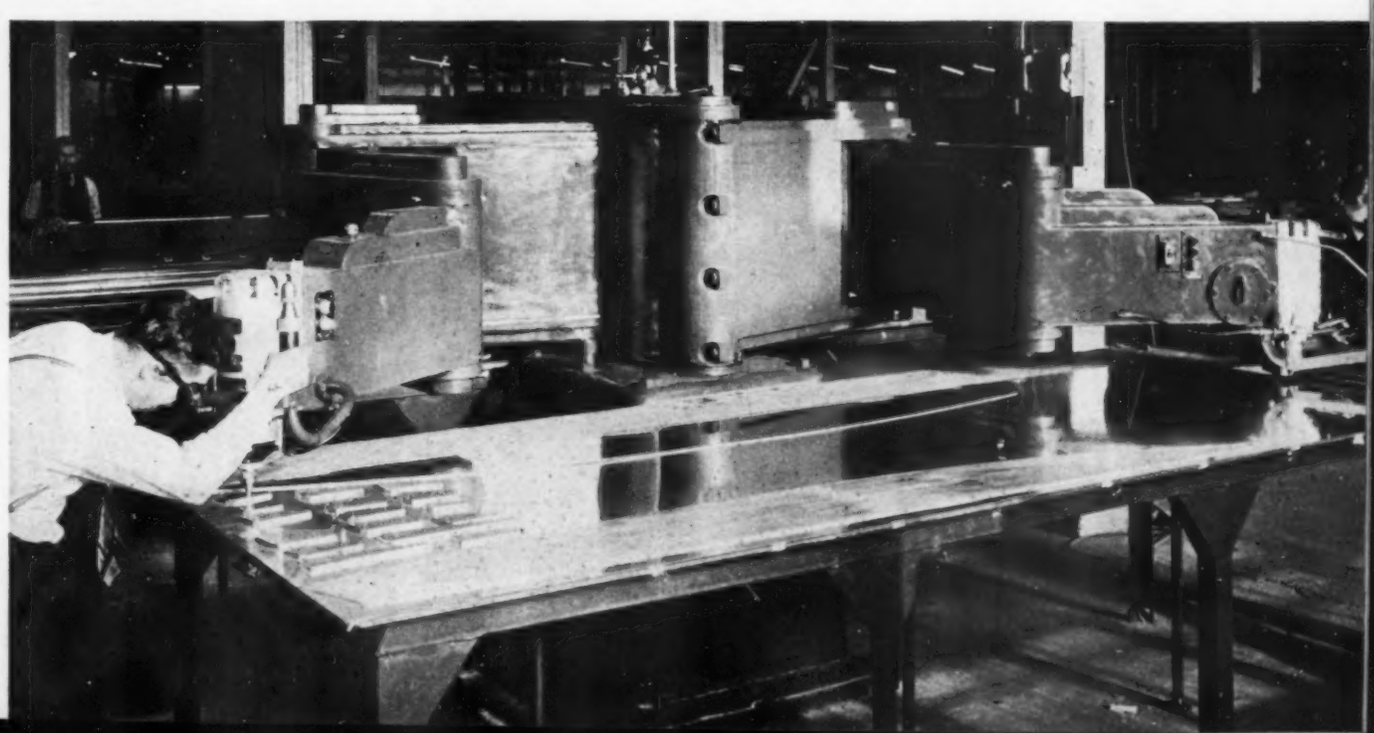
Men who made motor cars now extrude 1,300 aluminum sections for bombers. Three-week classes teach others the tricks of riveting subassemblies. One thousand women workers being put through school to learn the trade on war work

WHEN THE Hudson Motor Car Company stopped manufacturing automobiles early in 1942 in order to convert its facilities 100 percent to the production of material for our armed services, the company already was well underway on an extensive program to manufacture pistons and rocker arms for the Wright Cyclone aircraft engine in its own plant, and was supplying the management and personnel for the Detroit Navy Arsenal which already had been in operation for a number of months.

Today, the program for making Wright engine parts has been expanded, a new aircraft division has been formed to make fuselage sections for bombers in the buildings formerly devoted to the manufacture of rear axle assemblies, and other war contracts are being negotiated. Probably the aircraft division established to make fuselage sections is the best example of the type of conversion found most practical by Hudson engineers.

To set up this division, Hudson

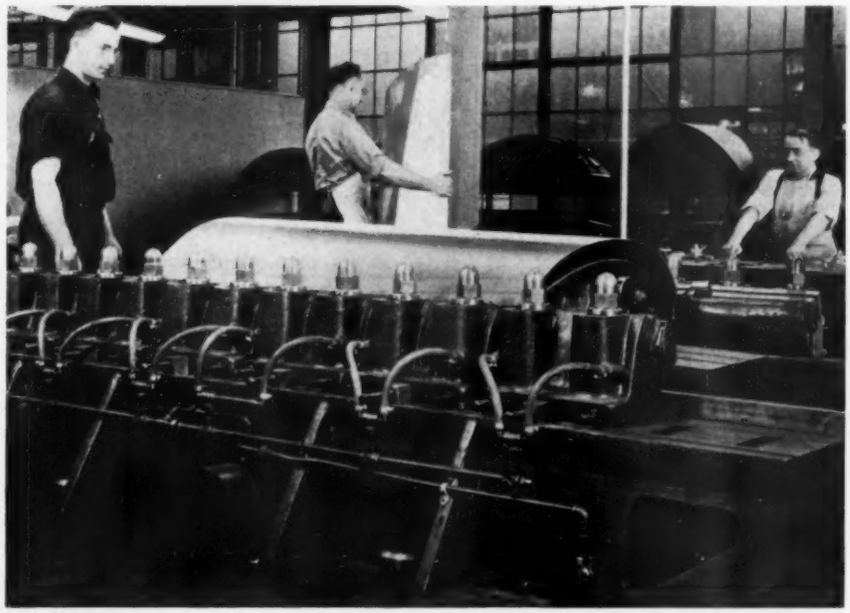
A large combination radial arm router and drill is used to cut out and predrill aircraft sheets in multiple thicknesses. Sheets to be cut are stacked on the table and as many templets or patterns as possible are nested together on top of the sheets so that various shapes can be cut in one operation. This machine eliminates the need for many blanking dies, and is typical of the new equipment installed by Hudson to speed production of aircraft assemblies



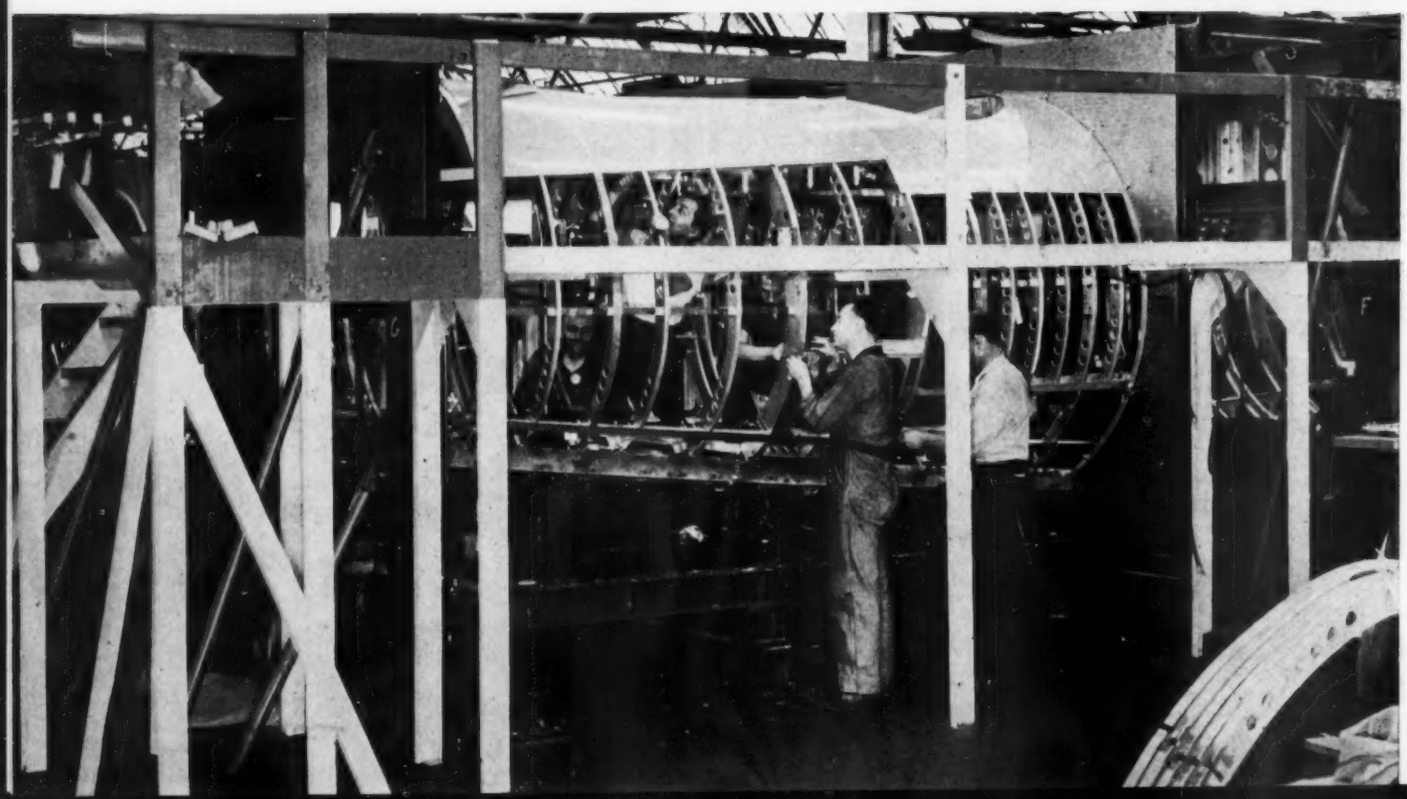
moved all of the machines out of its rear axle department to make room for assembly operations, and converted its export building into a parts manufacturing plant for the fuselage subassemblies. Into this parts department have gone a large number of small and medium sized presses formerly employed for automobile parts production. Here, the conversion of these machines to war production has meant simply a rehabilitation program to put the presses in good condition for operations on aluminum, and a tool building program to provide the necessary blanking and forming dies. Also installed in this parts plant are a number of special machines developed by working sheet aluminum, as well as some standard shears and press brakes

After being used as masters in the manufacture of forming tools, the mahogany masters serve as inspection gages for formed aluminum shapes. They are checked frequently to insure against wear and warpage

This 300-ton hydraulic "skin stretcher" forms fuselage sheets in Hudson's aircraft division. The form blocks are cast in molds for which mahogany master forms are used as patterns. Later, the forms are used as gages

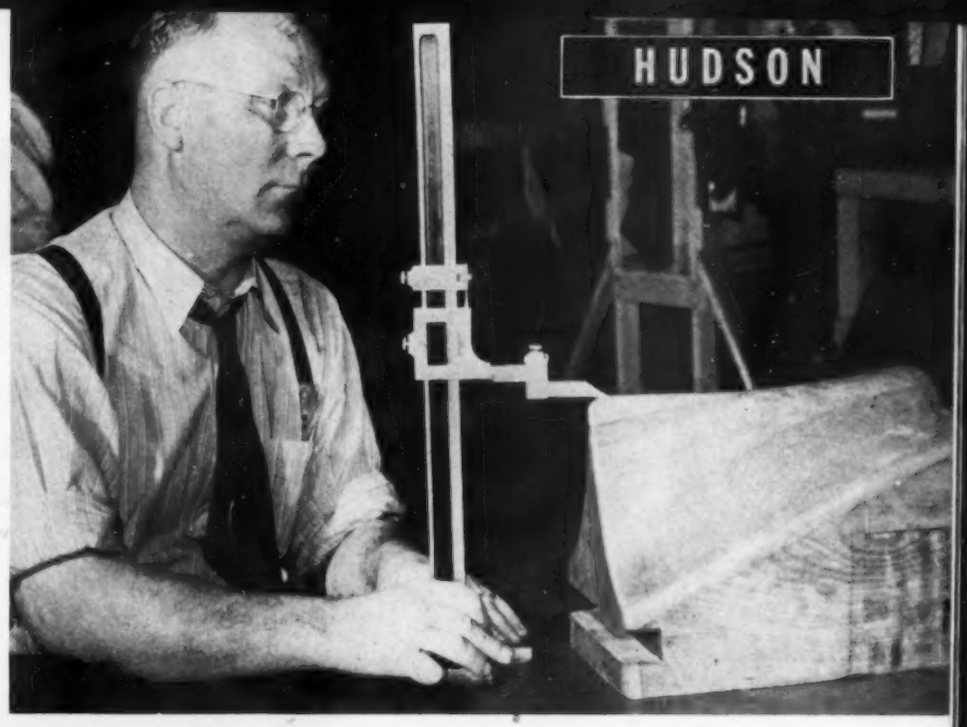


Subassemblies go to master frame jigs for final assembly of the fuselage unit. When completed, the fuselage section is moved to a second fixture where it is located on its side for riveting under-body areas



needed for the manufacture of many individual sheet-metal units for the fuselage and its subassemblies.

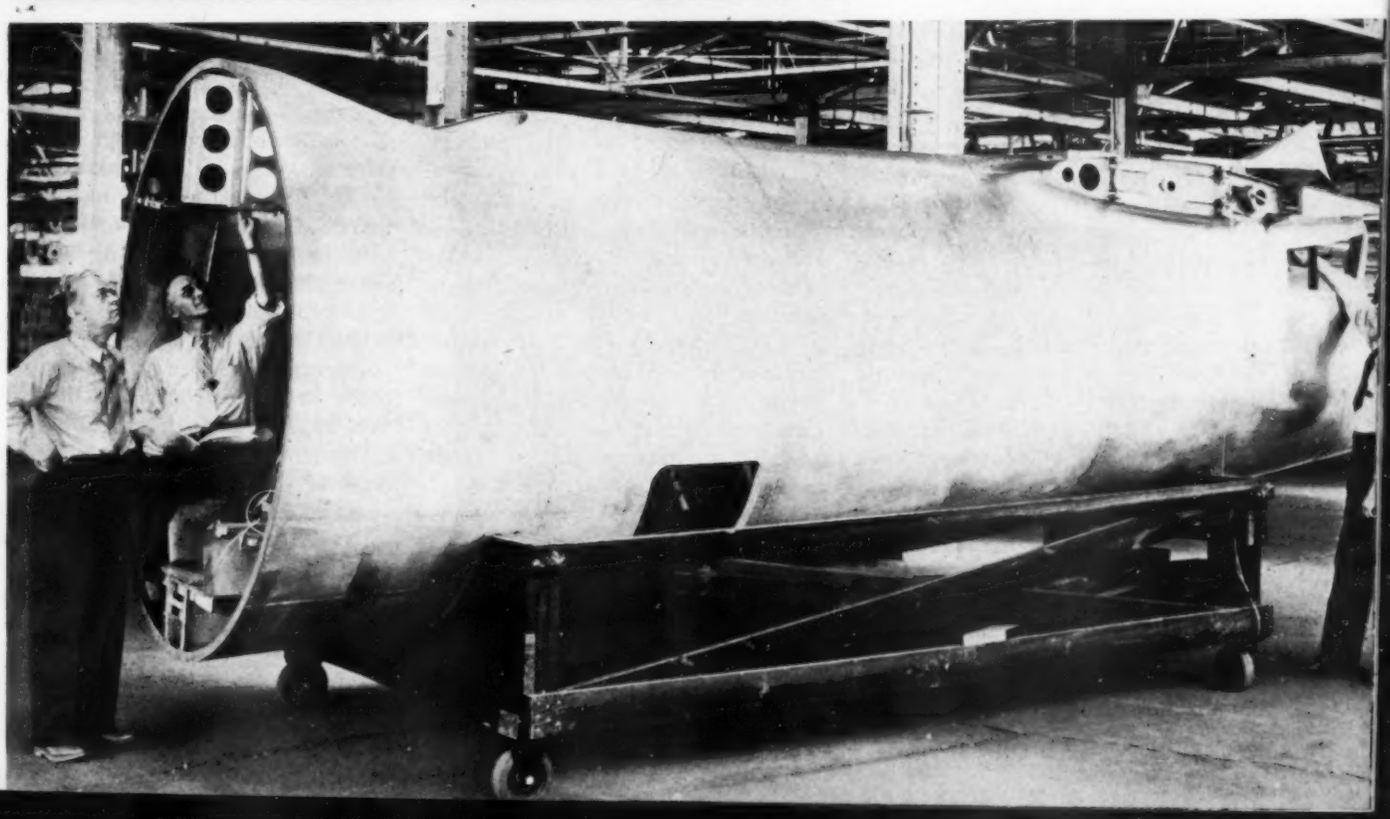
One of the most important "conversions" in this division has been the use of highly skilled model makers for the production of mahogany models which are employed first to make the forming dies, and then to inspect the parts formed in these dies. When used as inspection gages, these models are checked at frequent intervals to make sure that no wear or change of shape has taken place. Where some hand forming is necessary on the parts produced in the forming dies, steel blocks are made to the same shape as the wood models, and then the parts formed on these blocks are checked against the wood model as an inspec-



Skilled model makers formerly employed by the automotive division now serve by making master models of mahogany which later are used to inspect formed shapes

Formed parts for the bomber fuselage go to subassembly groups where individual sections are put together in carefully constructed fixtures. Practically no trimming is necessary during assembly

Assembled rear fuselage sections for bombers are supported in special cradles for final assembly and inspection operations. From here they are transferred on the same carriages to special freight cars



A major subcontractor for aircraft engine pistons, Hudson now is turning these units out in large quantities. Very little equipment from the automotive production lines could be assigned to work on these parts

tion operation to speed production.

In setting up the parts department for the aircraft division, Hudson found it necessary to train a large group of automobile workers in an entirely new line of work. A separate school was set up in this department, and both men and women were given a three weeks course in the forming and riveting of sheet aluminum assemblies. These training classes still are operated on a three-shift basis, and employees selected for the course given in this school are required to take preliminary classes in nearby public schools. Graduates are used to dilute the expanding groups in the parts and assembly departments.

Of the 2,500 parts and assemblies which go into the rear fuselage section being made by Hudson, 1,300 parts are made from extruded aluminum sections and from sheet aluminum. All of these are now being made by former automobile workers in Hudson's aircraft division parts department. Hudson's management is justifiably proud of the fact that these parts match closely and that practically no fitting is necessary during the assembly operations. Most of this success is attributed to the use of wood models made accurately to loft drawings supplied by the Glenn L. Martin Company.

The Hudson division set-up to make Wright aluminum pistons operates day and night on a six-day week basis. One of these airplane engine pistons weighs from 4.92 to 4.96 lb., as against a total of 5.25 lb. for the eight pistons formerly used in the eight-cylinder Hudson engine. This division has for some time been a major source of supply of pistons and rocker arms for the Wright engine plant.

One of the first automobile manufacturers to establish war production training schools to fit male automobile workers for war production work, Hudson recently has been leading the way in assisting women automobile workers to prepare for a number of war production jobs and so release skilled men for other armament work. The first classes of women completed their training course recently in special schools conducted by the company, and three new classes already have begun. Under the plan, more than 1,000 women formerly doing work in the automobile departments will be given an opportunity to attend classes. The school trains the women to read blueprints, how to handle and read precision instruments, and offers a review course in shop mathematics. In addition, Hudson has employed a number of older men retired in peacetime because of age. Some are more than 70 years young. These men have skills in tool and die making, and tool designing, which are much needed today.

Motor Cars to Munitions — NASH

Automotive Practices Effective In Producing Airplane Propellers

PARTICIPATION of the Nash-Kelvinator Corporation in the manufacture of weapons for our armed forces started more than a year ago when the company's various divisions still were actively engaged in the manufacture of automobiles, refrigerators and other consumers products. Today, the airplane propeller production program being supervised by the corporation has been under way for a number of months, and the company's other divisions rapidly are converting their facilities to war production.

The aircraft propeller project was started from scratch, and with only a skeleton organization drawn from the company's other divisions. The success that has been attained in this particular project has been possible because of the organization's knowledge of mass production principles, as well as the splendid cooperation afforded by the various government agencies and by the Hamilton Standard Division of United Aircraft Corporation, whose variable-pitch,

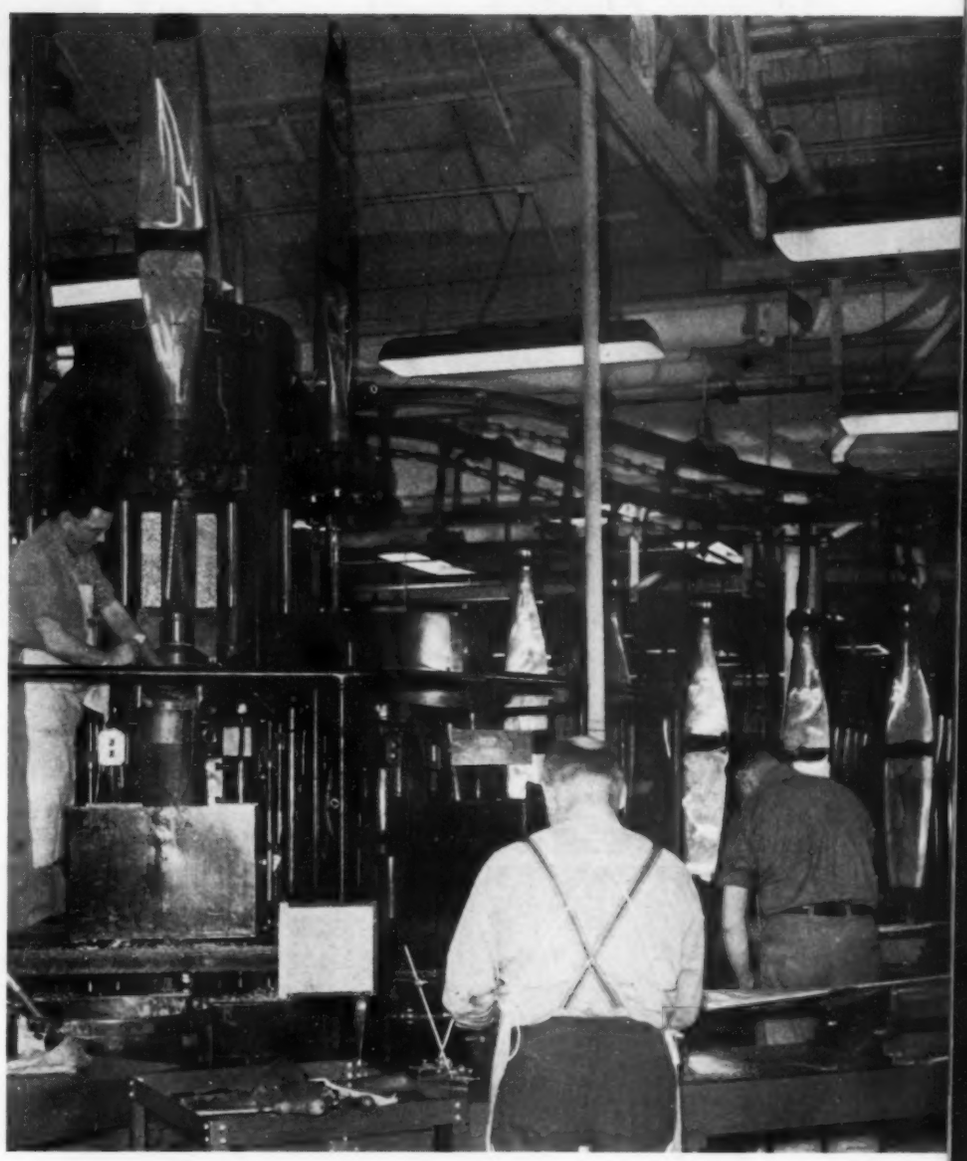
The automotive influence in setting up progressive machining lines in the Nash-Kelvinator propeller plant is well illustrated by this view of a portion of the line set up for machining rotating cams from heavy steel forgings. All of the machines in the plant are new, because of the great difference in necessary operations between propeller parts and automobile parts, but the machines are arranged for mass production, rather than job-lot production, of the parts

constant-speed, full-feathering propellers are being made.

The buildings selected for this activity have stood idle for more than ten years and were in rather poor physical shape when taken over. Even so, within four months after the last contract for repairs was signed, the first propeller was shipped and accepted by the United States Army Air Force. Now, the production facilities are being expanded rapidly to take care of the ever increasing load being thrown on propeller manufacturers throughout the country by the increased demand for bombers and fighter planes.

Because only one model and one size of propeller is being made, it has been possible to make use of mass production methods, not economic where every job going through the shop calls for some variation, whether large or small, in the product being made. While a number of the 18 principal parts required in the assembly of these three-blade propellers require special machines and tools, a number of them can be made on standard machine tools in somewhat normal set-ups. Special machine tools are required, of course, for the blades, and a few of the other parts, and these machines necessarily take time to design and make. In order to get started quickly in the manufacturing program, manufacturing operations and machine tool equipment already in use in other plants manufacturing this same propeller were selected for the initial machining lines set up by Nash-Kelvinator. The same thing is true of the standard machine tools required for some of the parts, since it was decided early in the program to adopt methods used elsewhere on this propeller, and then to make changes which will speed up production after the line actually was in operation.

Even so, automotive thinking has had its influence. Roller conveyors are used to transfer pieces from one machine to the next down the progressive machining lines in the departments making parts for the operating mechanisms. Overhead monorail conveyors with special hooks are employed for transporting semi-finished, and finished blades from operation to operation. The division's tool engineers are busy, also, going over the original set-ups in order to determine where changes economic-



While practically all other operations on propeller blades and control mechanisms have been fully mechanized, final finishing of the blades themselves still is an art which so far has defied mechanization. The skill of the workman determines the accuracy of the blades in these final operations

Finished propeller parts go to a final inspection group where they are Magnafluxed and then checked 100 percent for dimensional accuracy and quality of finish. It is interesting to note that many hand operations still are necessary on the parts shown in order to achieve the smooth blending of radii and the quality of surface finish necessary

Handling of propeller blades on overhead monorail conveyors is the principal contribution of the automobile industry to the manufacture of Hamilton Standard propellers, since it eliminates many trucking operations, and prevents damage to the blades. Each hanger on the conveyor is fitted with rubber pads

ally can be made in the interest of greater manufacturing speed and lower production costs.

One of the major factors affecting the success of the Nash-Kelvinator aircraft propeller production program has been the success of the training scheme initiated at the start of the program. A large number of supervisors and key production operators were sent to the Hamilton standard plant in the East for three months of intensive training. Upon their return, these men served as the nucleus for the larger organization which has been built up for an all-out program. There has been no time to set up special training classes for machine operators or hand finishers of propeller blades, and it has been necessary to train these new employees directly on the job. The training problem has been particularly severe in the department where propeller blades are finished by hand after the blades have been rough machined in special follower-type form millers. Hand finishing operations are divided into roughing operations and final finishing and balancing operations, with the men being upgraded from the first to the second group as their skill increases. The finishing department is surrounded by a plywood screen to eliminate air currents which would affect the accuracy of the final balancing tests. Every precaution is taken to insure highest quality.

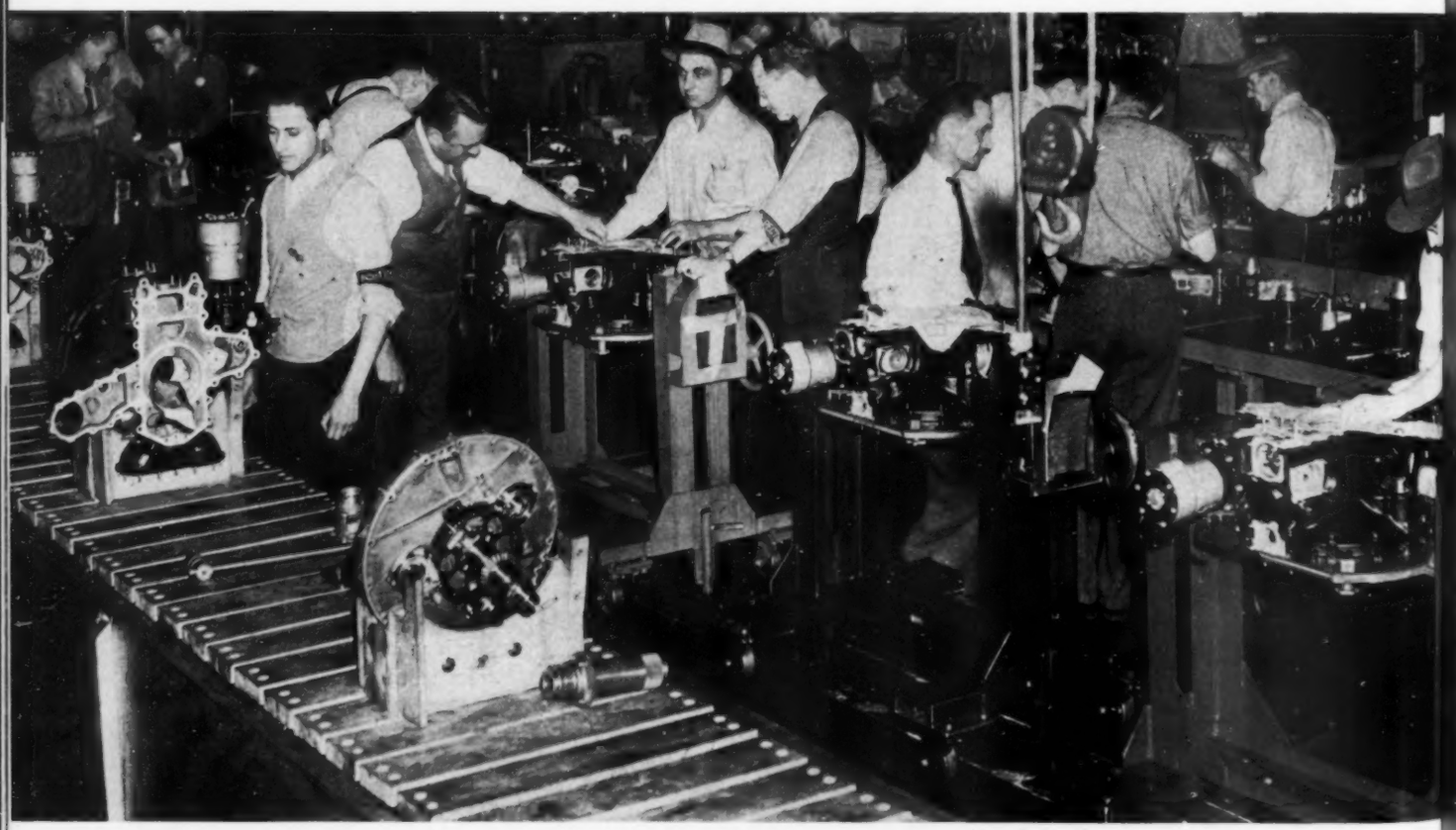
Because of the nature of the work, it has not been possible to subcontract any of the machining operations on the parts being manufactured by this division. Rough forgings are received at one end of the plant in motor trucks or freight cars, and are delivered directly to a storage area near a physical testing laboratory. A laboratory check is made on each critical part to insure that each piece delivered to the machining line meets the stringent requirements necessary if the propeller assembly is to withstand the tremendous loads imposed upon it when the airplane takes off and is in flight.

Each part is checked frequently between machining operations by floor inspectors, then at the end of the line it is delivered to a final inspection group where it is checked 100 percent by shop and government inspectors. Finally, subassemblies and assemblies are inspected thoroughly to insure proper functioning of the completely finished units before they are crated and shipped from the plant.

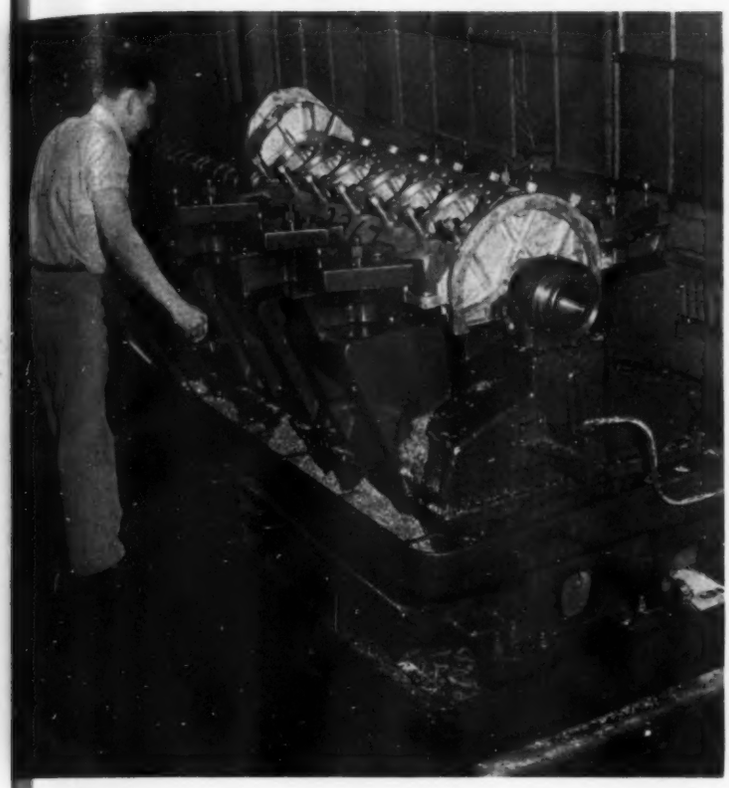
Motor Cars to Munitions — **PACKARD**

Retooled Factory Speeds Output of Aircraft and Marine Engines

In the production of marine engines three machine tools have been drawn from the car division for every two new ones purchased. Credit ingenuity in conversion



Automotive production engineering principles have been followed throughout the marine engine and aircraft engine divisions in converting Packard's plant to war production. In the group shown, a subassembly for the aircraft engine is being put together in a separate group. Note that parts are brought to the group on a slat-type conveyor and that special assembly fixtures mounted on casters are used to position the unit for finishing operations



Line boring and reaming operations on the upper crankcase section for the marine engine are performed in this converted horizontal boring and drilling machine. In effect, a special machine was secured by making the heavy fixture an integral part of the table. Accuracy is insured by guiding the long boring bar in a pedestal bearing at the tail end of the machine

Standard Bridgeport vertical millers have been converted for accurate form milling operations on marine engine connecting rods by mounting Turchan hydraulic duplicator heads. Accuracy is improved and production greatly increased by making the operator responsible only for proper operation of the controls, rather than for repositioning the cutter for blended cuts

MORE THAN a year before the United States became involved in the war, the Packard Motor Car Company started to convert its automobile facilities to the manufacture of marine and aircraft engines for the armed services. Already, Packard-powered Navy boats have played an important part in actual combat.

Until Pearl Harbor, Packard maintained production of automobiles while marine and aircraft engines were being produced in separate divisions. Today, only six months after December 7, production equipment has been ripped out of the automotive division and these departments have been retooled for the production of parts needed by the other two divisions to meet greatly expanded production requirements.

In the rapid expansion of the marine engine division, many machine tools are being transferred to war work in the car division; in fact, during the first quarter of 1942, more than 20 percent of the parts required for the marine engines were made in the converted car division. This will be increased to about 70 percent by the end of the summer. For the marine engine project alone, three machine tools are being drawn from the car division for every two new machine tools purchased. Machine tools not needed by the marine division and the aircraft engine division are being made available to the automobile industry's machine tool pool.

The aircraft engine being made by Packard is an adaptation of the Rolls-Royce "Merlin" engine developed in England. In order to get the job under way, Packard had to redraw more than 2,000 parts sketches and revise all manufacturing information in line with American practice. Working more than 3,000 miles away from the source of information, this was a tremendous engineering job. Yet, in the short space of 40 weeks, the company had created production facilities for these engines which were larger than its automobile capacity.

In addition to revising the manufacturing information, Packard had to purchase and install some 3,000 machine tools for the aircraft engine division; only a small percentage of the machines needed by this division being drawn from equipment available in the automobile division before it was shut down. Packard found it necessary to develop some 300 sources of raw materials and subassemblies in order to get the aircraft division started.

In converting its automobile production facilities to the manufacture of parts for marine and aircraft engines, Packard has followed very much the same practice adopted by practically all of the rest of the industry. Each machine tool in the plant first was surveyed and recorded in a card file. This record then was used by Packard engineers in determining which machines could be converted for use in war production lines. Those machines which could not be converted were made available to the pool for use in other plants. Already, a large number of presses have been removed for sale to other industries. Likewise, Packard has

drawn a number of machines from the pool for installation in its engine part groups.

Because the marine engine and aircraft engine projects were started long before car production operations were stopped early this year, activities in these two divisions were at a sufficiently high level to permit rapid transfer of car division employees to war-production operations. In addition to providing new production facilities, including machine tools, jigs, fixtures and gages, Packard therefore has been faced with a major training program in order to get into production quickly at the production levels made necessary by the extent of our war production program.

Insofar as possible, production workers in the two engine divisions have been trained on the job. In recent months this has been found inadequate and a separate training school has been set up in one of the departments made vacant when car production equipment was moved out. Soon the school will be operating on a two-shift basis and will train up to 900 employees a day. Some 15,600 sq. ft. of floor space has been made available for this school, and nearly 100 machines have been installed.

The school course averages six weeks, followed by four weeks in the shop under trained guidance before the employee is put "on his own" in the production lines. When it is considered that recent estimates show that Packard must hire and train between 2,000 and 3,000 new employees annually in order to cover replacement needs, it is seen that this school is all important. The acute shortage of skilled labor which is anticipated will be caused by increased production requirements, the stepping up of production elsewhere which probably will cause some shifting of labor from plant to plant, increased military selective service demands, and other normal labor turnover.

The school is planned to teach the new employees on a "learn-by-doing" basis, under competent and practical instructors. Each new employee is instructed in blueprint reading, the use of the micrometer and other gages, the function and care of cutting tools, safety precautions, and how to operate drill presses and engine lathes.

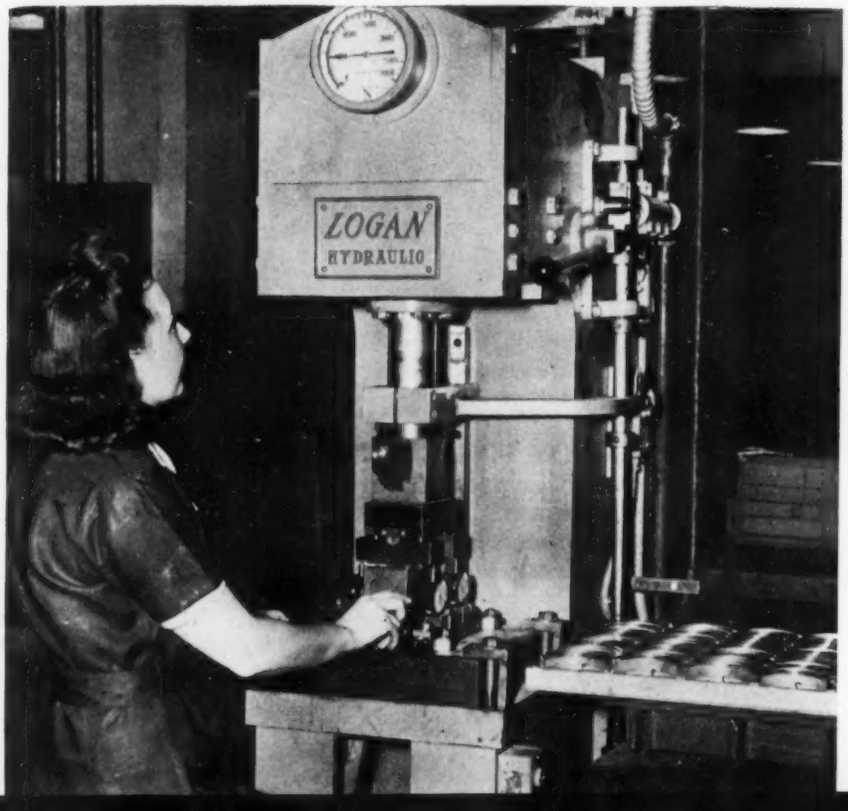
In order to keep before each employee, whether a supervisor or a production worker, the need for keeping production at a high level, Packard has worked out a "Work to Win" program in cooperation with the local labor representatives and the War Production Board. This program is designed to increase shop efficiency by: (1) A plan of general information and publicity for employees; (2) a system of award for production merit by departments and by individuals; and (3) a display and record of joint progress toward a given production goal. In the words of Donald M. Nelson's March 2 broadcast, the plan " . . . is no sly scheme to speed up men and machines for profit's sake. It is instead a job in which we all can take a hand, and share in its success. Out of it must come greater production. . . . "

Individual workmen are given an opportunity to share in this program by making them eligible for recognition through suitable awards. A board made up of two workers from the shop department, two members of the department supervisory staff, and a plan committee member judges the merit of individuals recommended to the board by foremen or other shop employees. Outstanding excellence of individual workers is recognized through awards of specially designed pins. Departments which maintain records for high production efficiency are rewarded by banners hung in those departments. Departmental efficiency is judged by weighing such factors as (1) the ratio of accepted parts produced to the number of such parts scheduled, (2) the efficiency of the department in producing those accepted parts, and (3) the cost of the scrap produced by that department during the same period.

The conversion of machine tools from automotive to war production has not been an easy task. Machine tools which were entirely satisfactory for automobile work have been found unsatisfactory for operations on marine or aircraft engine parts because of wear at certain points along the ways, or because they were designed only to perform certain operations on specific parts. It has been necessary to thoroughly overhaul practically all of the machines converted to war work in order to secure the required accuracy in production. Between 20 and 40 machines have been rebuilt each week since the automobile division was shut down.

Some of the machine tool conversions have been quite interesting. For instance, a Boye & Emmes toolroom lathe has been made available for internal grinding of the counterbore in one end of the marine engine crankshaft by mounting a Dumore grinder on the carriage and installing a coolant system. Likewise, a number of horizontal boring and drilling machines have been equipped with special fixtures for line boring and reaming crankcases.

Packard already is employing a large number of women in its aircraft engine division. They serve as operators of light machines and as inspectors on the smaller parts. As time goes on an increasing number of women will be put through the training school and assigned to production operations in the shop



Revamped Assembly Lines Roll Out Heavy Army Trucks

Complete new assembly line with more than twice as many conveyors turns out four times as many units a day. Nine out of ten truck parts are subcontracted, come in as subassemblies

THE STUDEBAKER CORPORATION has converted its passenger car and commercial truck shops and assembly lines to the production of heavy military trucks. In addition, it has completed three new factories for the machining and assembly of Wright aircraft engines. Production of equipment by Studebaker for our armed forces is rapidly approaching monthly shipments valued at almost twice the monthly average for the company's best civilian production year.

A nucleus of skilled supervisors and workers for the aircraft engine plants was formed by superintendents, foremen, toolmakers and machinists from Studebaker's engine, passenger car and commercial truck plants at South Bend, Ind. Promotion of these men, combined with hiring skilled workers and training new men, has been instrumental in the company's rapid increase in production of war material. At the peak of its war effort employment will reach several times that of the South Bend automobile establishments when all motor car work was halted at the end of January this year.

Although specific rates and dates of production of military trucks and aircraft engines are necessarily restricted, it can be said that the engine plants are approaching peak production. They are now completely equipped with both general-purpose machine tools and those designed especially for machining aircraft engine parts.

Aside from the aviation engine program, Studebaker's changeover to date has been relatively simple. Before our entry into the war, the South Bend

Truck frames are set in an inverted position on the first conveyor section. All frame and running board brackets are assembled with heavy-duty hydraulic riveters

automobile plant had been producing heavy-duty military trucks for some time. These trucks are heavier and more powerful than commercial vehicles of comparable capacity, since they are built to climb 50 percent grades and to withstand cross country travel far more severe than that demanded of ordinary highway trucks. Yet by careful planning on the part of both army and automotive engineers, the number of changes from standard specifications have been held to a minimum to permit production on assembly lines without extensive retooling. The outstanding departure has been allwheel drive, which greatly increases the number of driving parts required, such as axle assemblies and drive shafts, and adds to the production problems because of the greater number of operations required in machining the extra gears, pinions, shafts and housings.

Studebaker's early entry in the manufacture of heavy trucks has been a deciding factor in quickly stepping up production. Subcontractors had already been assigned orders for making over 90 percent of the parts for the trucks.

Motor car assembly line methods were applied to the first trucks built. Output was then increased substantially in February by employing equipment released by the termination of automobile and commercial truck production. This was accomplished by first removing all equipment conveyors and tools to make room for a completely new set-up for the heavy trucks.

New Equipment Speeds Production

Conveyors of the latest type, as well as modern spray booths and latest designs of tools were installed. This required the removal of 500 ft. of old conveyors, and the installation of 1,200 ft. of new conveyors, with an additional 600 ft. for painting the trucks. A repair shop was added where inspection and necessary repairs are made after the trucks have been given a rigorous break-in run. The new set-up increased Studebaker's production of military vehicles 100 percent daily.

The truck line was placed in Studebaker's spring division where miscellaneous equipment for making spring clips, studs, bumperettes and brush guards were moved to a new location in the foundry. However, the main layout of the spring division proper was not changed, there being sufficient room available for the installation of the truck line after rearrangement of the previously mentioned equipment. Hydraulic, electric and pneumatic tools, as well as air and electric lifting hoists, were added to the line to speed assembly of the heavy truck chassis. They permit the use of moving assembly line methods which heretofore had not been attempted for heavy trucks.

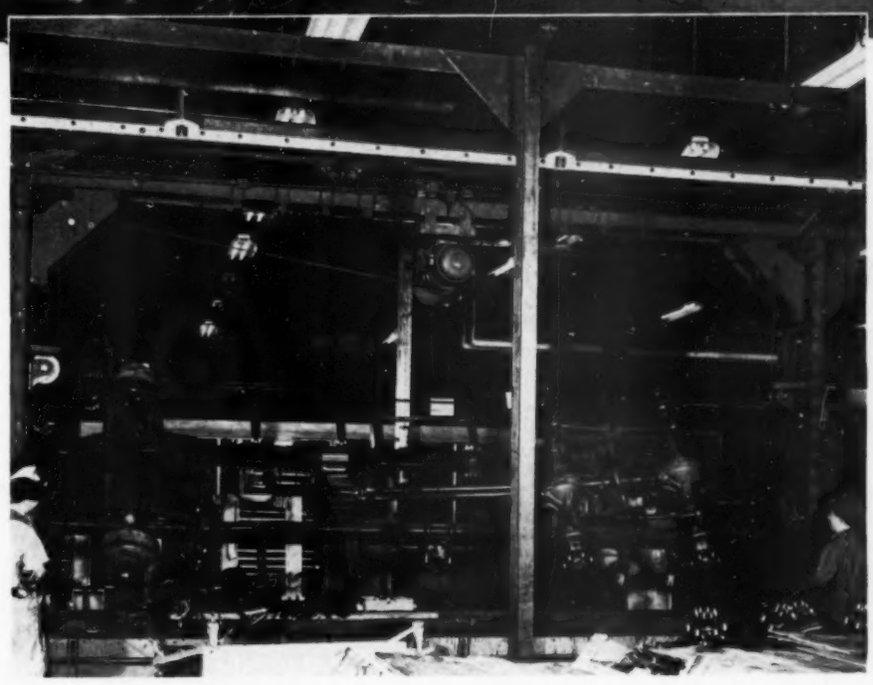
All sheet metal parts for the trucks, except the cab, gas tanks and running board brackets, are made at the plant. Subcontractors furnish frames, motors, axles, transfer cases, cabs, transmis-

Springs, complete axle housings and the transfer case are added to the chassis at the first station on the second conveyor section. After bearings and wheel hubs are greased, the chassis receives a coat of prime paint

sions, gas tanks, radiators and running boards. In all, over 90 percent of the truck parts come to the plant as complete subassemblies and are fed directly to the assembly line.

Assembly starts by placing the frame in an inverted position on the first conveyor where all brackets are applied with the aid of hydraulic riveters. The frame is lifted from this conveyor and placed on the second section of the assembly line where front and rear springs are attached to the chassis while it is still in an inverted position. Subassemblies of front axle, rear axle and transfer case, which are assembled off at the side of the line, are then fed into the main line and bolted to the chassis. Wheel hubs and bearings are greased with high-pressure equipment developed especially for these heavy-duty military vehicles. The chassis, moving continuously during the foregoing operations, then passes into a spray booth where a prime coat of paint is applied.

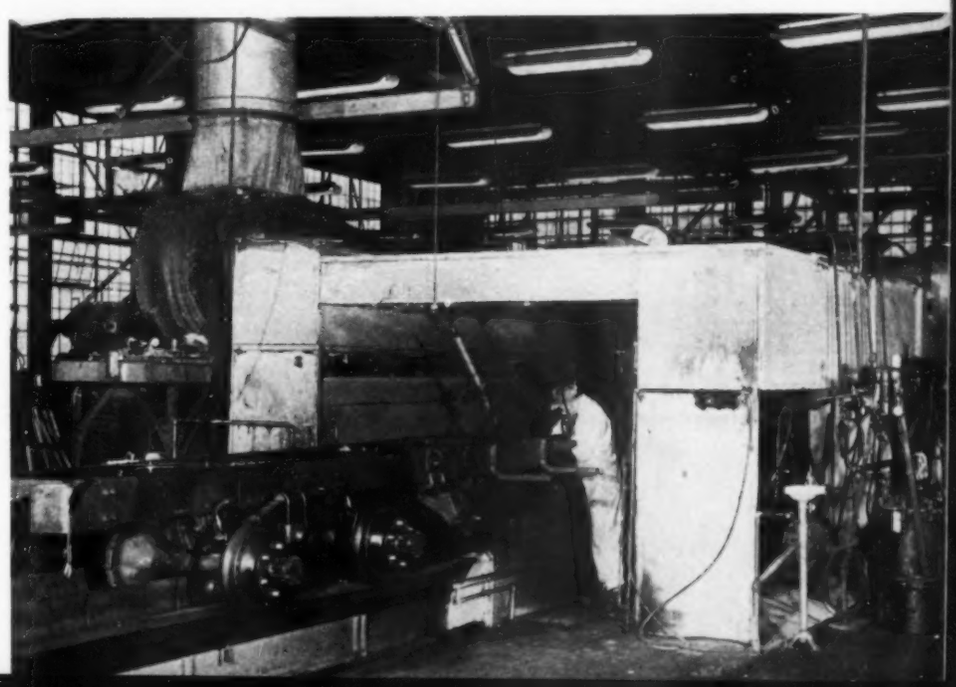
All the described operations are performed with the chassis in an inverted position on the conveyor. Immediately after coming from the prime spray booth, clamps are attached to the front and rear of the chassis and it is turned over by means of a remotely controlled electric hoist. The operation requires but 30 sec.



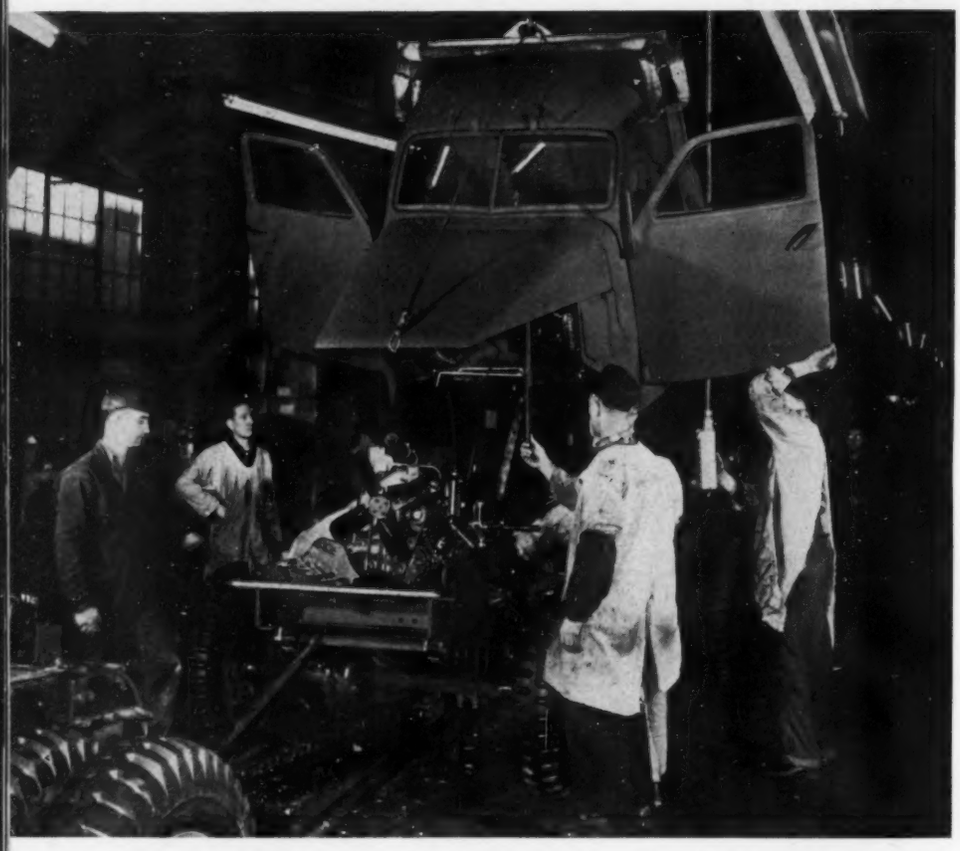
Before final assembly can be started, the chassis must be turned over on the conveyor. This is done with a remotely controlled electric hoist. The operation is completed in 30 seconds

At the remaining stations on this section of the conveyor, miscellaneous parts such as brake tubing, brake master cylinder and booster are added to the chassis. After passing through a water-wash spray booth, where it receives a colored coat of paint, it is greased, picked up by a traveling overhead hoist and delivered to the final assembly line.

Adjacent to the first station on the final line, tires are assembled to wheels by a special machine. These wheels



Brake operating equipment is assembled to the frame and axle housings immediately after the chassis is turned over. The conveyor moves it steadily through this water-wash spray booth for its first coat of paint



Engines for the trucks arrive at the plant in carload lots. Generators, fuel and oil pumps, carburetors, and other accessories are added on a special assembly line. The cab is assembled in Studebaker's body plant. Cabs are then fed directly to the final assembly line

Trucks leave the final assembly line under their own power. They are run onto traction dynamometers where plant and army inspectors check economy and performance characteristics of the engines

roll to the line and are bolted to the axles. As the chassis moves along the line, the motor is bolted in place, drive shafts are added, the cab bolted to the frame, and a pre-assembled unit of front fenders, radiator core and radiator grill is lowered in place by an overhead crane.

The chassis rolls from this location to a floor pit where all differentials, transmissions and transfer case are filled with grease. As the truck nears the end of the line, gasoline and water are supplied and the head lights adjusted. The engine is started and the truck driven off the line under its own power to a traction dynamometer where the engine is checked for economy and performance characteristics.

Trucks Get Rigorous Break-in Run

Army inspectors assume control of the trucks, and give them break-in run over smooth and rough terrain. Defects are corrected in a repair shop. The trucks are delivered to a final paint line where they pass through a naphtha wash, a paint spray booth and a drying oven before being inspected for delivery.

Minor assembly lines parallel or run at right angles to the main assembly line at many points. Chief among these are ones for the cab, engines and axles. The cab is assembled completely in Studebaker's Body Division, painted, trimmed and delivered to the final assembly line. Engines are delivered to the plant in carload lots and placed on moving conveyors where all accessories, including generator, fuel pump, oil pump, carburetor, spark plugs and wiring, are added; when they reach the assembly line, they are ready to be set into the chassis. Axles are assembled on their own line at right angles to the main assembly conveyor—here brakes are riveted to the axle and adjusted before being assembled to the chassis. With each 100 complete trucks, a certain percentage of extra axles are assembled for delivery to government stores.

Studebaker has diverted much of its assembly and production equipment from passenger car and commercial truck plants to the line now producing heavy-duty military vehicles. These vehicles are being shipped at a rate twice than at the first of the year. The assembly lines have been set up to increase further this production as the needs of our armed forces demand it.

Motor Cars to Munitions — **WILLYS-OVERLAND**

First Auto Plant Converted Goes in for Diversification

WILLYS-OVERLAND was the first automobile company to convert its plant completely to the production of war equipment. Over a year ago plans were developed for this conversion, and by January 16, two weeks before motor car production was halted, the plant was in all-out production of quarter-ton reconnaissance cars or Jeeps, shell, breech blocks and recoil cylinders for anti-aircraft guns, ammunition hoists for naval vessels, and aluminum forgings for the aircraft industry. Much of the existing equipment in the plant was converted directly to the production of these items. However, many new units were installed, especially in the aluminum forge departments, the ammunition-hoist machine shop, and in the shell line.

When the Army Jeep went into production in American automobile plants, the Willys-Overland light but powerful four-cylinder engine was selected as the power unit. The machine and assembly lines at the plant stepped up its production to meet this need, furnishing engines for the thousands of these reconnaissance cars now being produced monthly by Willys-Overland and the Ford Motor Company.

Assembly lines for the Jeeps wind through four separate floors in one building at the plant. Canvas cutting and stitching machines were renovated, rebuilt and augmented to produce the tops for these cars. Chassis frames, axles, wheel assemblies, bodies and accessories, many of which are produced in the body plant at the factory, are fed to the continuously moving assembly line. Partially completed bodies from the end of each section of the assembly line are lowered to the final assembly line on the first floor by electric hoists. The line is complete with spray painting booths and radiant-heat drying ovens. Cars leave the line under their own power ready for a break-in run under the control of Army inspectors.

The Army's quarter-ton reconnaissance cars are powered with Willys engines. The company's engine line is producing sufficient units to power the hundreds of Jeeps rolling daily off the assembly lines at both the Willys-Overland and one other automobile plant

The outstanding job of converting existing equipment to the production of war material is in the shop making breech housings and recoil cylinders for anti-aircraft guns. When the order for machining the forgings was obtained, machine tools could be obtained only on long-term delivery. The main machine shop at the plant had many general-purpose machine tools which with suitable tooling could be used for machining the forgings. But most of the machines were old and not suitable to finish the parts to the tolerances de-

Long before motor car production was halted in January, Willys-Overland had devoted most of its assembly lines to making Army jeeps. The remaining lines were converted with little or no dislocation of equipment and personnel

manded. While these machines were being rebuilt by expert machinists hired specifically for the work, engineers prepared drawings for jigs, fixtures and tools to do the job. Tooling and repairs were completed at the same time, and the job went into production. Not a single new machine went into this line, but regardless of this fact production figures first equalled and then bettered anticipated output. Some of the illustrations reveal the age of the machines on which this work is being done, as well as showing the general design of jigs and fixtures used.

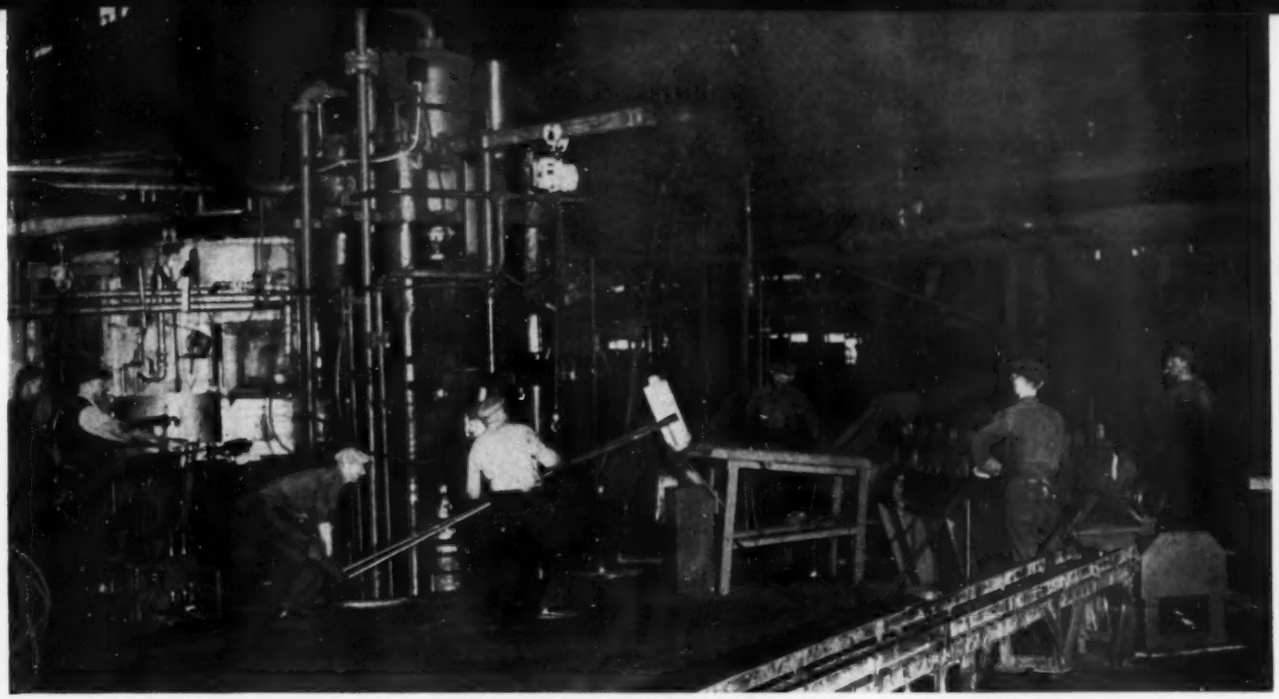
The breech housing is a long forging of medium diameter, necessitating fixtures which in many cases overhang the machine tables, especially those on milling machines. In general, the fixtures are all similar. They consist of a heavy base casting with accurately located seats for nesting the forging. Swivel clamps retain the forging in the seats. These accurate fixtures, combined with the precision of rebuilt machines, has accounted for an almost unbelievable number of finished forgings being shipped weekly.

Each machine in the production lines for the breech housing and recoil cylinders is set up for one operation on each forging regardless of how simple or difficult it may be. The forgings pass from machine to machine until they are completed. There is no time wasted in tearing down a set-up once it has been added to the line. The production of these gun parts is indicative of what engineering ability and initiative can accomplish with existing equipment to further production of even the most precisely machined elements for armament units.

Concurrently with the contract for breech housing and recoil cylinders, Willys-Overland installed the line for forging, machining and heat-treating high-caliber shell. Hydraulic forging equipment, operating at 2,000 lb. per sq. in. pressure, rough forms the shell

Machine tools were rebuilt and tooled for machining breech housings of anti-aircraft guns. This conversion is outstanding because of the age of the machines and the close tolerances on the work

Jigs and fixtures were designed for the rebuilt machine tools producing breech housings. All fixtures have heavy bases and accurately machined seats for nesting the forgings. Positioning clamps hold the forgings in place



Willys-Overland is producing thousands of shell daily. Billets are forged in two operations on a vertical press and horizontal draw bench. The shell cavity is forged to within 0.060 in. tolerance with the outside diameter

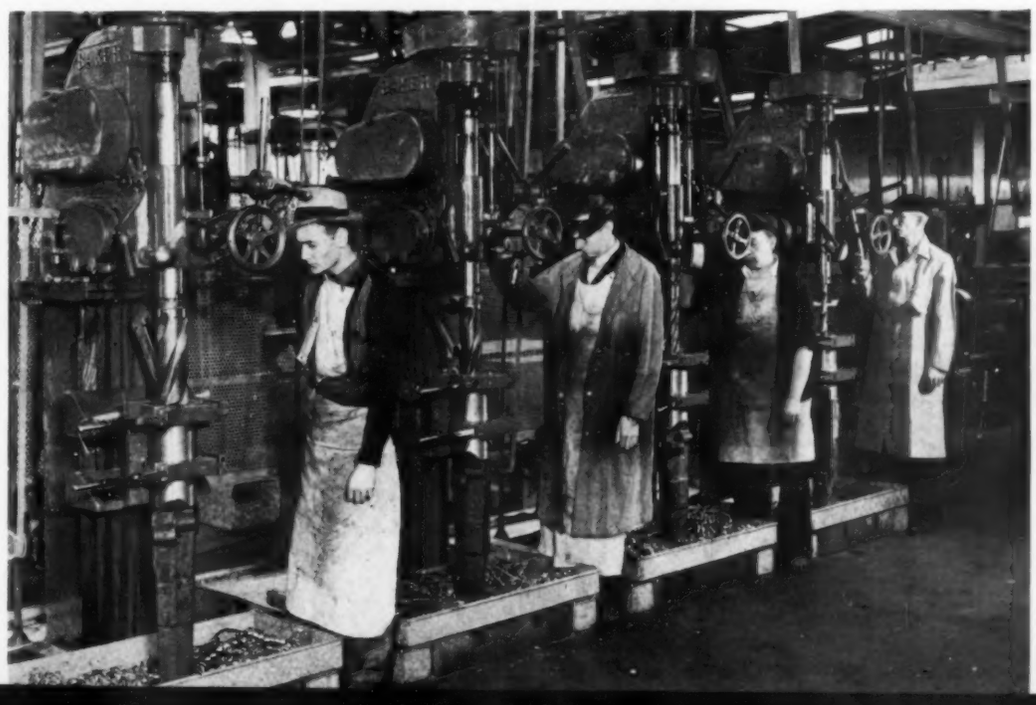
in two operations. Half of the cavity, held to 0.060 in. tolerance with the outside diameter, is forged in a vertical press. The other half of the cavity is formed in a horizontal draw bench, from which the forging is delivered by roller gravity-type conveyors to shot-blast cleaning units. Continuously moving conveyors deliver the shell from this point in the line to centering machines, body-turning lathes, heating furnaces and nosing presses, then to machines for boring, threading, grooving and banding them. Conveyor lines run the length and breadth of the plant, limiting the manual handling of the shell to a minimum. Heat-treating furnaces were originally diverted from the motor plant, but these have been replaced by continuous-type units necessary to handle the thousands of shells produced daily.

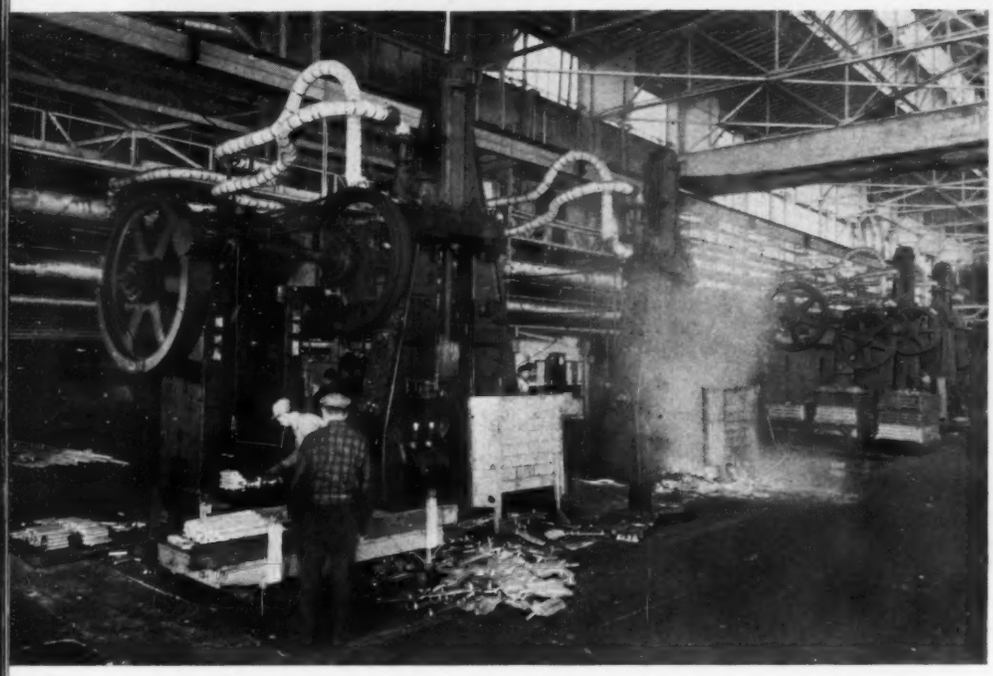
Finished shell are delivered to automatic painting, drying and stenciling equipment by conveyors which also carry them past factory and government inspectors. Finally the shell are either crated or delivered directly to railroad sidings for loading in box-cars.

Conveyor lines in the shell plant are typical of those used in the handling and routing of parts on any automobile assembly line. It is here that car manufacturing methods have found application to speed production beyond that found in many plants engaged earlier in making ordnance items. Although most of the machines on the line are new, the layout of equipment and installation of conveyors by experienced engineers has resulted in outstanding daily production of shell.

The forge shop, originally laid out for production of parts for the Willys-Overland Americar and light commercial trucks, was expanded at the beginning of the company's war effort. This was completed by the time car production was halted in January. The added furnaces and forging hammers

Once a machine tool in the breech-housing line is tooled up, it is not disturbed regardless of the simplicity of the operation. The fixtures are designed so that the forgings pass from machine to machine until it is completed. The work is indicative of what engineering ability and initiative can accomplish with existing machine tools





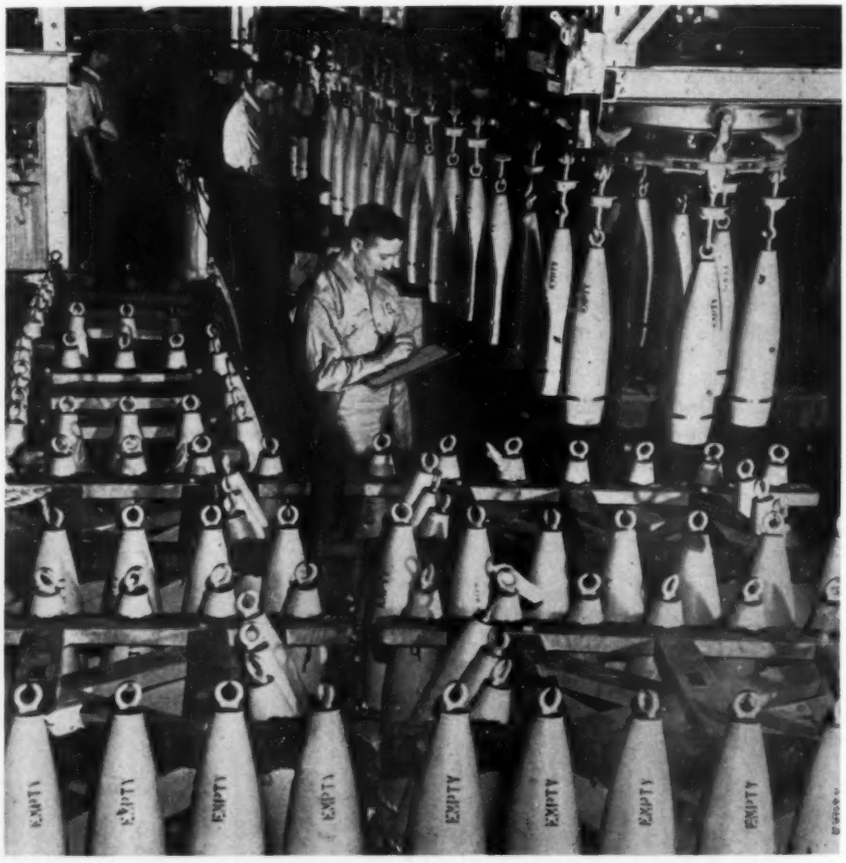
The Willys-Overland plant now has a fully equipped aluminum forge shop. It was built by the company's engineers and forge shop personnel who worked for months in other aluminum shops which cooperated in the project. A new machine shop will soon supply aircraft companies with finished parts

made it possible to make increasing numbers of Jeep engines for both Willys-Overland and other producers of the quarter-ton reconaissance cars.

One of the outstanding jobs undertaken successfully by this company was the production of aluminum forgings for aircraft companies. Heating furnaces, forging hammers, trimming presses, as well as cleaning and inspection equipment were installed in an entirely new division of the factory. Engineers first studied the problems attendant with forging of aluminum, and together with forge-shop foremen and steamhammer men visited plants successfully engaged in the work. After months of study and working at the cooperating plants, Willys-Overland installed its own equipment. Additional furnace men, hammer operators, trimmers, and inspectors were trained for the work. Today the plant is in full operation turning out thousands of parts daily. As rapidly as machine tools can be installed, aircraft parts produced in the forge department will be finish machined, ready for delivery and immediate installation on airplane assembly lines.

Probably the most exacting machine work is being done on ammunition hoists for naval vessels. Each hoist requires the machining to extremely close tolerances of over 3,000 individual parts. No attempt was made to build jigs or fixtures for existing machines to do this work; rather the shop was equipped completely with new machine tools. Regardless of the close tolerances required on every individual part of the hoist, production has exceeded expectations. Furthermore, the accuracy with which parts are made has been instrumental in producing hoists which not only meet but exceed naval operating specifications.

The company is currently installing screw machines and heat-treating equipment for producing machine gun bullets. Within a matter of weeks every existing square foot of floor space in the original Willys-Overland plants, as well as shops of adjacent companies previously manufacturing commercial items, will be devoted to production of war material. But this does not represent the company's entire effort—it is subcontracting many minor assemblies and individual parts to more than 800 factories throughout the country.



The shell line is equipped from end to end with conveyors to minimize manual handling of the forgings. Although the majority of machines on the line are new, the layout of equipment and installation of conveyors by experienced engineers resulted in outstanding daily production of the shell

Adjustment of Bevel Gears in Assembly—III

The tooth bearing chart shown in Fig. 6 indicates the corrections to be made if the proper bearing is not obtained the first time. It should be noted that average conditions are assumed and special applications may require special considerations.

The sketches shown in Fig. 6 represent diagrammatically the possible tooth bearings on the gear member of a pair of correctly made spiral bevel gears. The sketches in one column show the opposite side of the tooth shown in the corresponding sketch in the other column.

If the amount of backlash is unsatisfactory after a suitable bearing has been obtained, it will be necessary to correct the position of the gear member as well as the pinion. In doing this, it is convenient to remember that axial adjustment has the opposite effect of the corresponding adjustment of the other member. Thus, by making adjustments in the same direction in amounts proportional to the numbers of teeth, the backlash can be changed with very little change in the tooth bearing. With a 2:1 ratio the gear would need to be moved twice as far as the pinion.

The accompanying sketches show the various types of tooth bearing which may be encountered in bevel gears.

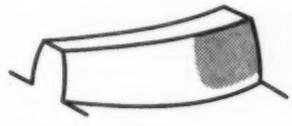
CONCAVE SIDE	Tooth Bearings on Driven Gear	CONVEX SIDE
	Correct tooth bearing position with accurate and rigid mounting.	
	Out of Position Bearing Cause: Pinion too close to cone center. Remedy: Move pinion away from cone center.	
	Out of Position Bearing Cause: Pinion too far from cone center. Remedy: Move pinion toward cone center.	
	Cross Bearing Cause: Shafts do not intersect. Remedy: Line up shafts.	
	Cross Bearing Cause: Shafts do not intersect. Remedy: Line up shafts.	
	Toe Bearing Cause: Shaft angle too large. Remedy: Correct the shaft angle.	
	Heel Bearing Cause: Shaft angle too small. Remedy: Correct the shaft angle.	

Fig. 6—Tooth Bearing Chart

STARRETT TACTICIANS

Backing Up The Men At The BATTLE STATIONS

(UPPER PICTURE)
Checking dimensions of Trunnion Bearing Boxes with a Starrett Micrometer No. 224 and Vernier Height Gage No. 454. Photos courtesy of Goss Printing Press Co.

(LOWER PICTURE)
Surfaces are scraped to limits of plus or minus 0.001"—an operation that calls for frequent checking with precision measuring tools. The operator in the background is using a Starrett Vernier Height Gage with Starrett LAST WORD Indicator attached. Starrett Dial Test Indicator No. 665 is shown in the foreground.

These scenes in the plant of the Goss Printing Press Co. show skilled American workmen building heavy caliber anti-aircraft guns for the U. S. Navy...a job that has already won the coveted Navy "E" pennant for excellence. In this plant, as in most plants throughout the "Arsenal of Democracy," Starrett Precision Measuring Tools are helping to maintain the highest standards of accuracy . . . helping to produce more and better planes, tanks, ships and guns for the fighting men of America.

THE L. S. STARRETT CO • ATHOL • MASSACHUSETTS • U. S. A.

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Adjustment of Bevel Gears in Assembly—IV

The meaning of the terms used is shown in Fig. 7. The appearance of an ideal tooth bearing for straight bevel gears is shown in Fig. 8. The area of contact starts at the small end of the tooth and extends about three-quarters of the length of tooth. It will also be noticed the tooth bearings are somewhat different in gear and pinion. The bearing on a pinion tooth is higher, that is, more on the addendum than on the dedendum. The opposite is true for a gear tooth.

Incorrect mounting has a direct effect on the location of the bearing and the deviation from the proper tooth bearing indicates the nature of the error. The effect is similar for both straight and curved teeth and the following remarks apply to both.

When the bearing is too high on the pinion and too low on the gear as in Fig. 9, the pinion is too near the center of the gear. This is corrected by increasing the pinion mounting distance. In the opposite case, with the bearing low on the pinion and high on the gear, the pinion mounting distance should be decreased.

If the shafts are not accurately located in the same plane, a cross bearing as in Fig. 10 will result. The contact will be concentrated at one end of the tooth on one side, and the opposite end on the other side. The shafts must be lined up to correct this.

If the shaft angles are not correct, all of the tooth bearings will be concentrated at the same end of the teeth. If all the bearing areas are concentrated at the toe or small end, as in Fig. 11, the shaft angle is too great. If all bearings are at the heel or large end, the angle is too small. It will be necessary to correct the shaft angle to obtain the proper tooth bearing in such a set of bevel gears.

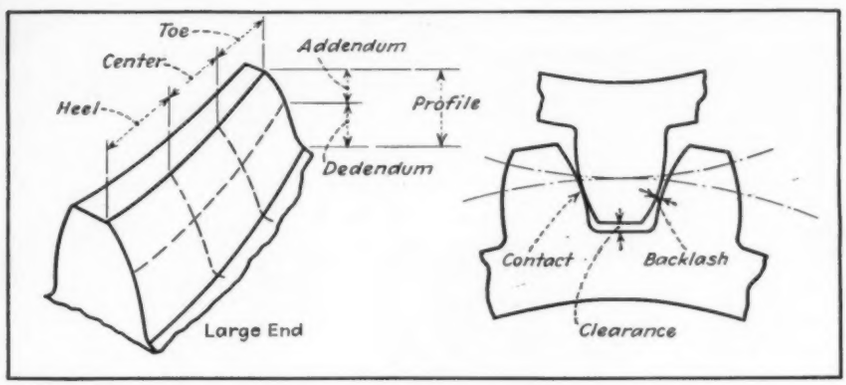


Fig. 7—Meaning of Terms

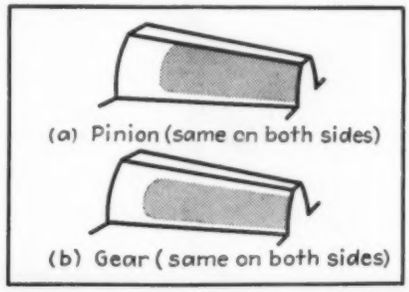


Fig. 8—Ideal bearings for straight bevel gears

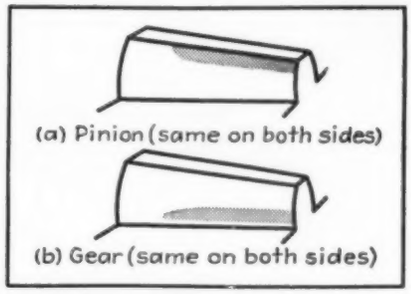


Fig. 9—Out of position

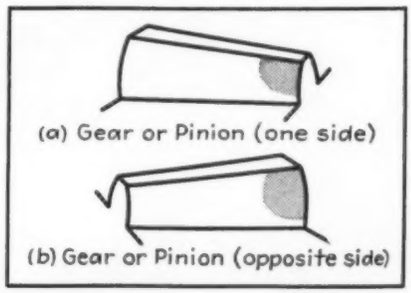


Fig. 10—Incorrect shaft position

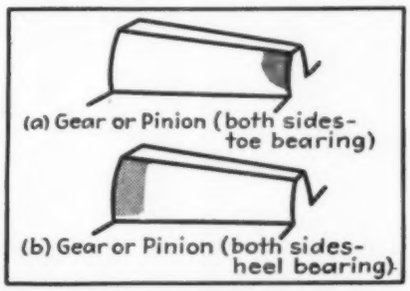


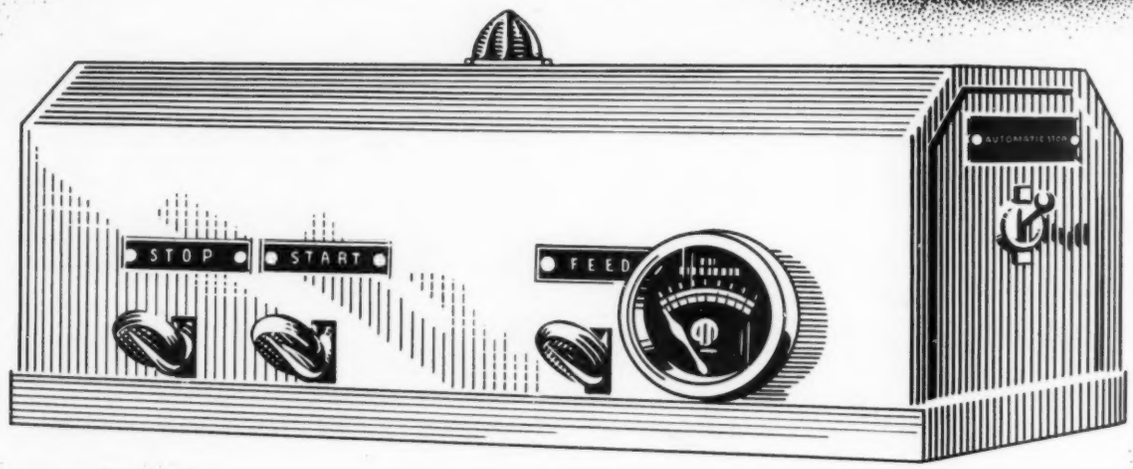
Fig. 11—Incorrect shaft angle

RULES FOR INSTALLING BEVEL GEARS

1. Always keep matched or lapped gears in their original sets of pairs.
2. Always replace both members of a pair.
3. Assemble lapped gears of even ratio with the teeth marked "X" together.
4. Make sure that there is the correct amount of backlash.
5. Check the tooth bearing.
6. Make sure that locknuts, bolts, etc., are tight. In the case of spiral bevel and hypoid gears be sure that both pinion and gear are locked against axial thrust in both directions.
7. Lubricate gears properly before operating under power.

THE automatic stop on a New Britain screw machine operates when stock is exhausted. It stops the machine with the spindle collet in the loading position open, and signals the operator.

The reason New Britains "get more done" lies in features like this one. To meet the call for machines capable of living up to America's all-out production schedules, we have stepped up our output to almost unbelievable peaks.



NEW BRITAIN AUTOMATICS

A complete line of chuckers — Four, Six and Eight Spindles to 10¼" Capacity.
Also a complete line of Multiple Spindle Screw Machines up to 2¼" Capacity.

NEW BRITAIN-GRIDLEY • MACHINE DIVISION
THE NEW BRITAIN MACHINE CO. • New Britain, Conn.

PURCHASING WAR BONDS GIVES YOU THE OPPORTUNITY OF DOUBLE SERVIC

It Is Happening Here

HITLER LOOKED across the Atlantic and said it couldn't be done. And even if it could be, it wouldn't be.

He thought America was too unprepared to get going on an all-out war production job before it was too late.

Moreover, his agents told him of our devotion to the three B's—the barrelhouse, the boogie-woogie and the blues. We worshipped at the shrine of crass materialism—more radios, more automobiles, more refrigerators, more luxurious living.

We were soft and didn't give a damn about anything except our own comfort and pleasure.

Unfortunately for his future health, Herr Hitler made a grievous error. He unwittingly challenged America at the thing which we do best. Mass production is our dish, not his (nor is it Hirohito's).

He reckoned without American industry. And he badly misjudged the character of the American people.

The manufacturers of this country tackled an assignment so stupendous that no other nation dared attempt it. With the help of Uncle Sam, they set out to catch up with Hitler's output of war goods and then to surpass it. They had to do in two years or less what it took Germany six years to do.

As time progressed, the production sights were raised. When President Roosevelt asked for 60,000 planes, 45,000 tanks and 20,000 anti-aircraft guns this year, most people felt he was expressing a hope which couldn't possibly be filled.

The results? Hitler may well rub his eyes in astonishment. The miracle which he felt couldn't happen is happening here. If he doubts the miracle, let him read the editorial pages of this issue. They tell the story of the automotive industry's transformation—from motor cars to munitions.

What is taking place at Detroit is happening throughout American industry.

Airplanes are coming off the production lines by the thousands, tanks by the hundreds, bombs by the tens of thousands. Mind you, these figures are not munitions "on order," but munitions currently being made in U. S. factories. The President's seemingly fantastic goal is likely to be attained.

And this is only the beginning. As Al Jolson used to say "You ain't seen nothin' yet.' The full force of our armament production is still to be felt.

All of which should be of great cheer to our government, to our soldiers and sailors and marines off in the far corners of the earth, and to our gallant allies.

The fact that we are on our way in the War of Production should spur us on to bigger and better achievements.

Who is bold enough to deny that the scent of victory, even though slight, should have the stimulating effect of making one fight harder than ever? One of the ways to end this war with complete victory in the shortest time is to produce more and more faster and faster.

America is doing that now.

Burnham Finney

GAGING BUSINESS

Emphasis shifts from speed to include efficiency as many projects are ahead of schedule. April machine tool output tops hundred million. Transportation problem acute

As production of war goods increases in the metal-working industry manufacturers are giving greater attention to installation of machinery which does the required job in the largest volume at the lowest cost. The emphasis at the beginning was to tool up and get into production quickly without regard to cost. The time element overshadowed all other considerations. Now that the program is progressing ahead of schedule in numerous cases, it is entering upon the second phase, where cost and efficiency factors are of growing importance.

A third consideration looms. As the war industries turn out goods for the United Nations in ever increasing volumes, more attention is being given to improvements in the design of planes, tanks and other military implements. The armed forces want planes with even more fire-power and speed and maneuverability and they want tanks from which the weaknesses disclosed in actual combat are eliminated. A large number of machine tools will be needed for tooling up production lines to manufacture the new and improved products. That phase of the war production program will keep machine tool builders busy for many months.

Machine Tools—Production of machine tools continued its steady rise as dollar volume for April exceeded $103,000,000. Production of all types of metal-working machinery has reached an annual rate of $1,300,000,000 and is steadily rising. Making allowance for March being a longer month than April, the output for April represents an eight percent increase over the preceding month.

In Booking orders, May was not so big a month as April for many machine tool companies. Both March and April were abnormally large because of an edict of the War Production Board has forced in a huge amount of business much of which would not otherwise have been placed so soon. In fact, many contractors, to be on the safe side ordered far more equipment than later surveys revealed that they needed, hence cancellations have been coming in to machine tool builders the past few weeks. Slight significance, however, is being attached to these cancellations.

It would be a mistake to assume that machine tool demand has reached the point where it may soon fall off. If the American experience should follow that of England, there will not be any lag ahead at all. The fact is that British machine tool builders are working harder than ever and at top speed. Incidentally, close to half of the working force of machine tool companies in England is women.

Machine tool output in the United States is continuing to rise as much new capacity comes into production. The increase of manpower, the growing number of plants with three full shifts and the enlargement of subcontracting are all helping to push upward the machine tool production curve.

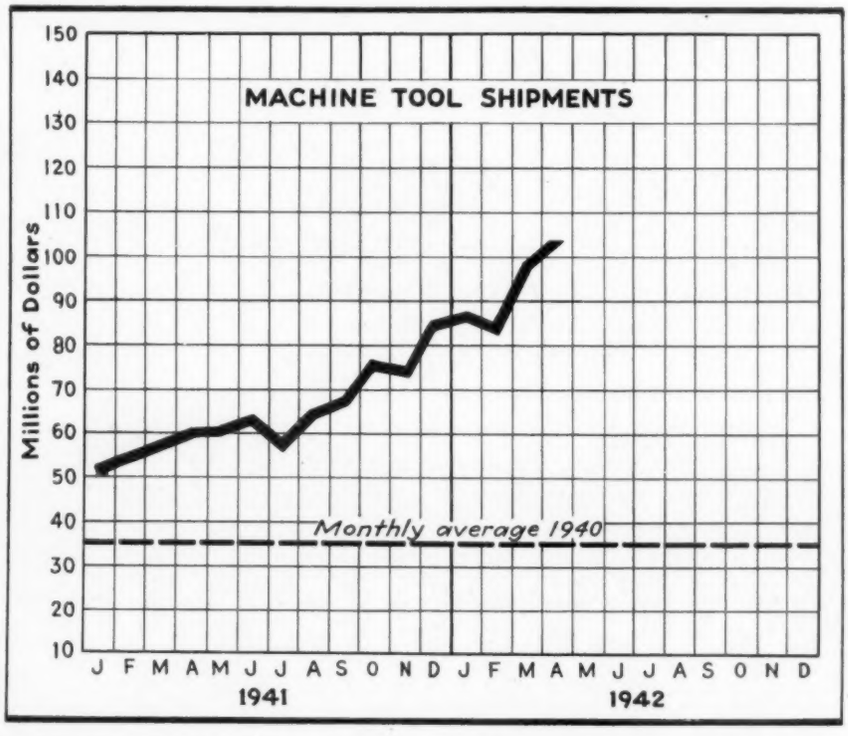
Many war contractors have been employing so-called expediters to visit machine tool builders to try to hurry delivery of the machines they have on order. The War Production Board has just issued a directive to the machine tool industry stating that manufacturers should disregard such expediters because deliveries are fully controlled by priorities and allocations and pressure tactics will not speed the coveted machines to contractors using such tactics.

Steel—All-time records for iron ore shipments were broken in May by Lake Superior ports. It is estimated now that before the 1942 season ends more than 90,000,000 tons will be supplied to steel mills from Minnesota and northern Michigan mines.

Manpower—It is estimated that by the end of 1943, an additional 18,000,000 workers will be needed for the U. S. war labor force. This coupled with a probable 4,500,000 more men in the armed forces will create critical labor shortages. A survey by the War Manpower Commission discloses that 384 out of 700 war contractors have been forced to reduce production because of skilled labor shortages. One proposal to meet this problem is by means of labor priorities.

Transportation — Transportation problems grow more acute despite steps taken to cope with them. Hampering state legislation on trucking has been suspended for the duration, but many shippers are wondering if their biggest problem today may not be one of getting materials and delivering war goods to the consignee.

Shipbuilding — Controversy about the value of the battleship has been renewed and it is significant that the Navy's new $8,300,000,000 request to Congress calls for 500,000 additional tons of aircraft carriers, 1,400,000 tons of other combat ships—mostly of the lighter types—but no battleships. Carl Vinson, House Naval Affairs chairman, says our two-ocean Navy will be completed in June, 1944.



Over the Top—Machine tool shipments passed the hundred million mark in April when the value of new machine tools shipped equalled $103,364,000. There were 25,415 units shipped in April, compared with 24,300 units—valued at $98,358,000—shipped during March

Code Numbers To Aid Material Allocations

After June 30 an identifying code number will be attached to all orders to show ultimate use of material. All producers will be covered, PRP applications are broadened

BY ROBERT COLBURN

WASHINGTON—As an aid to close and careful allocation of raw materials, the War Production Board is installing a system of identifying code numbers which must be attached to all orders placed by producers—after June 30. The code numbers indicate the ultimate use to which the material being bought will be put. These code numbers will stay with the order as it moves from supplier to supplier toward the ultimate raw material producer. Finally, a steel mill, say, will have a very complete picture of what the final uses are of the steel it sells. WPB's steel branch would then use this information in allocating steel.

All producers are covered by the Allocation Classification System. Orders placed by retailers and distributors are exempt. Thus, by August 1, WPB will have a clear identification of the flow of materials from the primary producer right down to where the goods move off the final assembly floor.

Simultaneously, WPB immensely broadened the application of the Production Requirements Plan when it required practically every firm—whether or not it needs priority assistance—to come in under the plan. Only general exception is firms needing less than $5,000 worth of metal in the third quarter. Builders, retailers, and distributors are exempt. So are a substantial group of industries which don't use raw materials, simply use operating supplies: transportation, utilities, mines and oil companies, communications, and sewage and drainage enterprises. Raw material producers, being at the end of the line of raw material flow, are also exempt.

Application Is Simple

Complicated as the allocation classification plan appears, it is really fairly simple in its application. Simplest case is that of a manufacturer of some finished product—machine guns, clothing, jewelry, or the like. He checks over the list of code numbers (see table on next page), finds that he fits in class 4.50, 15.00, or 23.00, as the case may be. Then he simply writes this number on every order he places—for anything, from bar steel to soap for the washroom.

A slight additional complication is that he must identify the type of purchaser to whom he sells—USA for army, USN for navy or Maritime Commission, LL for lend-lease, FP for other foreign purchasers, DP for other domestic.

If the manufacturer makes products fitting several classifications, he must show both classifications on his purchase order, indicating the percentage of the goods being bought which will go to each class. If this last is impossible, he may simply indicate the percentage which sales of each class bears to his total sales.

Overlapping Products

For example, a clothing manufacturer is devoting 75% of his output to men's suits, 25% to navy parachutes. His orders for wool would be coded DP 14.00. Orders for silk would be coded USN 6.80. However, an order for thread might have to be coded 25% USN 6.80 —75% DP 14.00.

More complicated is the case of a man manufacturing semi-fabricated items or parts which enter into the product of other manufacturers. Before he can place an order he must go through the orders he receives from his customers and find out where his product is going. Then he codes the orders he places according to the percentages of each code in the orders he receives.

Thus a manufacturer of screws might want to buy screw machine stock of a certain alloy. He finds that 18% of his orders for screws of that alloy are coded USN 6.60, 10% are USA 6.60, the rest is DP 11.20. He would code his order for bar stock accordingly.

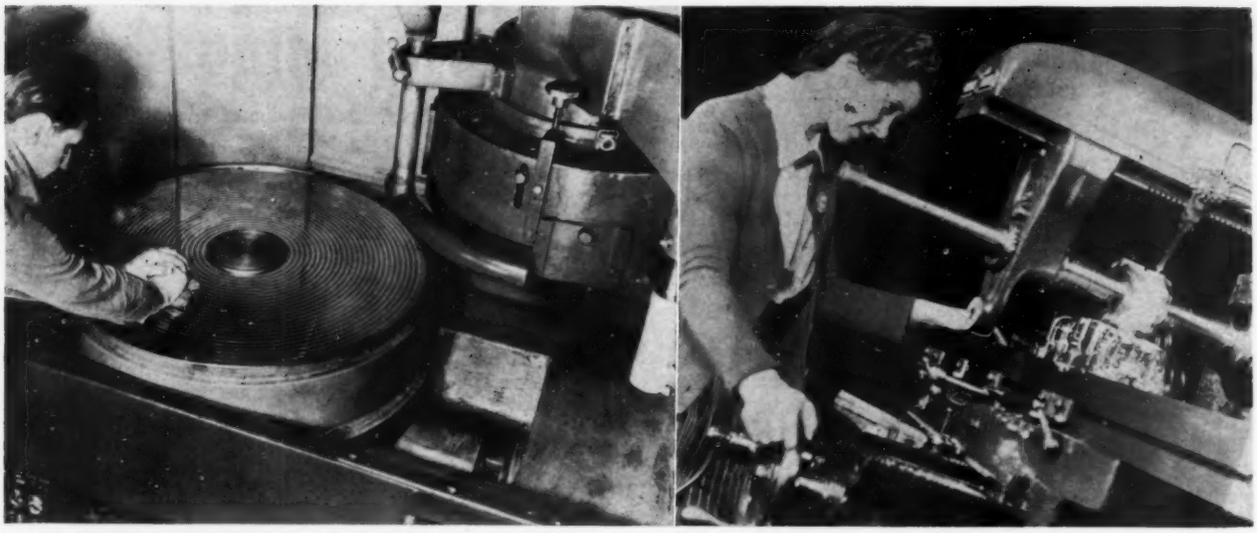
In this fashion, orders move along toward the final raw material producer carrying with them the identifying code numbers. Orders for iron ingot received by a steel mill might show percentages of every one of the 23 classifications. WPB can use these percentages in working out programs for allocation of iron.

Two important exceptional cases are Class 21 and Class 22. Orders placed for any building project are coded 21 no matter whether it is a clothing factory or a telephone central exchange. Sole exception is military buildings which are coded 7.

The code numbers are not priority ratings and have nothing to do with ratings. They are mere identification.

All orders placed after June 30 must be coded. Effective at once, all orders must be coded which call for delivery after July 31.

Proverb Proved—Another "impossible" feat was accomplished when the American Propeller Corporation dedicated a plant for the mass production of propeller blades for Army bombers. Above, Wayne Eddy (right), plant manager, explains the process to Stephen T. Early, presidential secretary. The blades are made from a single piece of seamless steel tubing which is honed and ground, hot swaged, forged, flattened, filled with gas to insure proper shaping and formed in a hydraulic press, welded, and finished. Steel blades are lighter than solid-aluminum blades in the larger sizes



The Sixty-Five Days—In the new Westinghouse Merchant Marine Plant, production of complex turbine parts calls for both speed and accuracy. The grinding machine (above left) has a powerful magnetic table which holds parts in place without the need of adjusting clamps. It also permits simultaneous finishing of several pieces of work. At right one of the many women operators in the plant demonstrates her skill at operating a milling machine, here shaping impulse blades for steam turbines. First parts were turned out just 65 days after erection of the first steel columns. Admiral Howard L. Vickery, vice chairman of the Maritime Commission, declared in a dedicatory address that "America today has more active shipbuilding capacity than all the rest of the world combined." He said that after the war this capacity will restore America to dominance in world commerce

WAR PRODUCTION BOARD ALLOCATION CODE

Every manufactured product falls under one or more of these allocation classification code numbers. Every order placed by a producer after June 30 must carry a code number. The numbers are not priority ratings, are not in order of importance. Their whole purpose is to tell WPB where orders for raw materials are coming from, enable it to allocate materials intelligently among the orders placed.

1.00 aircraft
2.00 ships
2.10 battleships
2.20 aircraft carriers
2.31 escort vessels (aircraft), combat, loaded transports and cargo ships
2.32 patrol vessels
2.33 landing craft
2.40 light cruisers
2.50 destroyers including escort
2.60 submarines
2.70 all other types of naval craft
2.80 repairs to all naval vessels
2.90 ships for Maritime Commission
3.00 vehicles
3.10 tanks and armored vehicles
3.20 all other vehicles, except rail
4.00 armament and weapons
4.10 aircraft
4.20 anti-aircraft, barrage balloon, equipment, A.A. searchlights
4.30 artillery
4.40 fire control, all types
4.50 machine guns—ground, hand arms
4.60 naval, all types
4.70 tanks and anti-tank
4.90 weapons of all other types
5.00 ammunition
5.10 ammunition 20 mm. and above
5.20 ammunition below 20 mm.
5.30 bombs, depth charges, mines, and torpedoes
5.40 propellants, chemicals, explosives
5.50 pyrotechnics
6.00 war equipment and supplies
6.10 chemical warfare equipment and supplies
6.20 clothing, general supplies, subsistence
6.30 mapping, map reproduction and photographic equipment
6.40 medical equipment and supplies
6.50 military field construction equipment
6.60 military radio and wire communications, Radar or electronic equipment
6.70 military railway including rail vehicles and bridge equipment
6.80 supplies and equipment—all other military types
6.90 all other supplies and equipment
7.00 war facilities
7.10 air fields, bases, camps, coast defense, depots, forts, navy yards, posts, stations—in U.S.A.
7.20 same as 7.10 but outside of continental U.S.A.
7.30 munitions manufacturing facilities and proving grounds—government owned
7.40 Panama Canal
7.50 shipyards and ship repair facilities —government owned
8.00 raw materials
8.10 all metals
8.20 all chemicals
8.90 all other raw materials
9.00 power, light and heat
9.10 electricity
9.20 petroleum
9.30 coal and coke
9.40 gas
10.00 transportation
10.10 railroad, urban and interurban
10.20 automotive
10.30 roads, streets
10.40 water transportation, including construction of private shipyards
10.50 air transportation
10.90 all other transportation
11.00 communication
11.10 telephone
11.20 radio
11.30 telegraph
11.90 all other communication
12.00 public health and safety
12.10 sanitary and health systems
12.20 health equipment and supplies
12.30 public safety equipment and supplies
13.00 agricultural equipment and supplies
14.00 industrial food processing
15.00 wearing apparel
16.00 household use equipment and supplies
17.00 education and information
17.10 printing and publishing
17.20 education
18.00 recreation and amusement
19.00 office use equipment, supplies
20.00 industrial use equipment and supplies
20.10 metal working machinery
20.20 all other machinery
21.00 building construction
21.10 buildings for manufacturing and commercial purposes
21.20 all types of dwellings
21.90 all other types of building
22.00 operating supplies and building repair and maintenance
23.00 all other end uses—excludes parts for products in other classes

INSIDE DETROIT

Auto industry ahead of schedule as deliveries for first six months of war nearly a billion and a half. Cutting tool plants must work towards around-the-clock production

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Six months after Pearl Harbor, the automobile industry is ahead of schedule on "assignment after assignment", reports the Automotive Council for War Production. "All of the plants are now using materials as rapidly as they are received under government allocations. In all of them production rates are rising daily."

Deliveries in the six months ending June 7 surpassed $1,400,000,000, equal to one-third of orders on hand Dec. 7. Current orders exceed $14,000,000,000—a production job equivalent in materials and man-power to turning out 15,000,000 cars and trucks, or 300 percent of the peak annual output in peacetime.

Citing scores of specific instances, the Council's report "The Job is Being Done", shows that adaptations of automotive technology to "mass production for mass destruction" are resulting in an "outpouring of the tools of war, the magnitude of which the world has never seen before".

Automotive engineers, collaborating with ordnance experts, have introduced new production methods, saving much time and money per unit. A parts plant cut 25 percent from the time of making machine guns. A passenger-car producer cut 80 days from the period required by a British armament maker to fabricate an anti-aircraft cannon. Ordnance orders shipped out of Detroit in January totalled 1402; in April, 1850, and it has been predicted that "the current rate of shipments will be tripled in June or July".

A tank producer attained capacity production at a figure many times the original specification and not even considered a possibility when the first contract was signed. As much material is consumed daily as was handled in a full month a year ago.

As volume of orders and output increased, five successive price reductions have been made by the supplier of a Naval unit, the savings to the government now amounting to $10,000 per unit, or 37 percent less than the original price.

Air Power

On Dec. 7, two auto makers were producing aviation engines, now seven are turning out motors, and two more are tooling up. Carloads of motors are leaving certain plants daily.

Six companies are building airframes, several are making complete planes. One factory will produce a four-motor bomber every hour, equal to production of all Axis factories combined, and another plant has been approved. Tokyo knows the qualities of two-motor bombers, for the production of which a network of former body plants has been integrated into a series of sub-assembly lines.

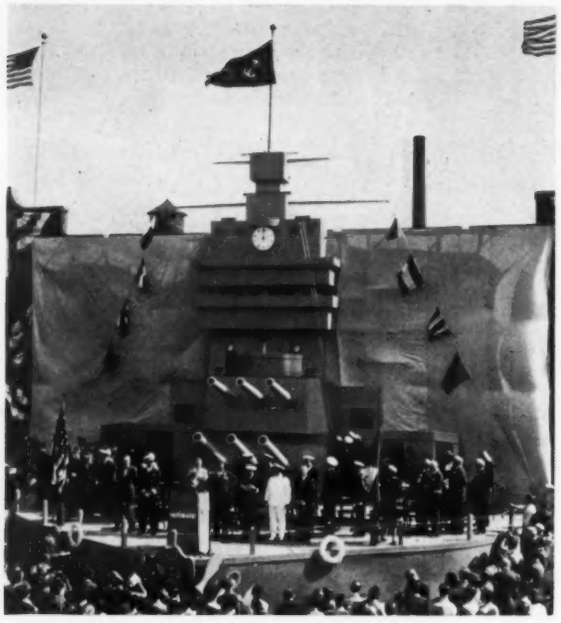
What the Automotive Council for War Production did not say is also important: since the auto plants are ahead of schedule they are consuming materials and perishable tools above the planned rates. Materials shortages are a problem now, according to E. C. Kanzler, Detroit regional manager, WPB. To supply arms plants with materials, the public will be asked to draw in its belt and "get along with what it has" even more than demanded to date. Reason for WPB announcement that defense housing will be drastically curtailed springs from the fact that new family-type housing projects are "wasteful" of critical metals in the form of public utilities. Now construction at outlying defense plants may be limited largely to barracks, which consume the least amount of pipe and wire per person housed. Family-type units may be restricted to platted areas already possessing public utilities, and even here the amount of metal per unit will undoubtedly be cut.

Cutting Tool Shortage

The threatened $150,000,000 shortage of cutting tools in 1942 (AM—Vol. 86, page 354g) is to be alleviated as far as possible through the building up of existing tool plants, large and small, so that they can work around the clock, or at least achieve two complete shifts. WPB has been given $15,000,000 which may be allocated at its discretion to prime and sub-contractors to build up production facilities, but not to erect new plant space. The program is to integrate production capacity of prime and sub-contract tool producers so that the cutting tool industry will be able to achieve the desired $400,000,000 annual production rate in a year's time. Sub-contracting will be pushed in this manner. Suppose the shortage lies in spiral-flute reamers. A sub-contractor can rough turn and flute the reamers if he is given a new milling machine. On the other hand, the prime contractor needs a few more grinders and another hardening furnace to take care of his own production and that coming from the sub-contractor. Both concerns will get the few needed machines, output will jump several fold. The prime contractor under this scheme retains full control over precision and quality of tools sold over his trademark, and the customer is assured of a satisfactory item.

Another problem facing the automotive industry is this: how much more arms work above the current $14,000,000,000 in orders can be allotted to

Efficiency Exceeds Estimate—Production methods for bombers are much more efficient than supposed; original employment estimates have been cut in half. Contributing to speedy output is this wing-assembly fixture, from which an assembly is lifted every few days instead of every few months



Ship Ahoy — More than 3000 people attended ceremonies held aboard this battleship replica when the Automatic Transportation Co., Division of the Yale and Towne Mfg. Co., received the Navy "E" Award. The award was made to W. Gibson Carey, Jr., president of Yale & Towne

Five Additional Directors For WPB Regional Offices

WASHINGTON—Five additional regional directors have been appointed in the War Production Board's move to decentralize operations. Thirteen regional offices are being established throughout the country.

The new directors are Joseph P. Maguire, New York; Leslie A. Miller, Denver; Wade T. Childress, Kansas City; Ross Eugene Risser, Dallas; and Harry H. Fair, San Francisco.

The six regional directors whose appointment has been previously announced are Orville H. Bullitt, Philadelphia; Ernest C. Kanzler, Detroit; Frank H. Neely, Atlanta; John C. Virden, Cleveland; Joseph L. Overlock, Chicago; and Walter H. Wheeler, Boston.

Regional Directors for Minneapolis and Seattle have not yet been appointed.

Detroit? Original peak-employment figures showed that the Detroit area would need 830,000 persons to handle the load. Labor estimates made for bidding purposes were based of necessity upon the only existing data—time standards in arsenals and in low-production arms plants. But in a number of cases, production know-how applied to mass-production quantities has cut man-hours per unit from 25-30 percent. In seeking more armament work, the Detroit Regional Branch of WPB took these examples into consideration, reduced the 830,000 figure by ten percent to compensate for technological improvements in arms manufacture. E. C. Kanzler has also asked 125 manufacturers in the Detroit area to submit new estimates, based on current knowledge, and to furnish monthly reports, so that all available resources of manpower and equipment can be put to work. The new figures are likely to show that the revised figure of 755,000 employees is about right for peak operation on present contracts. To obtain an adequate picture of the number of employables remaining in the Detroit area, studies must be made of the number of women who can take arms jobs, and the number of persons who will be released by curtailment of the construction industry and certain other non-manufacturing lines of business.

Exchange Production Ideas

NEWARK—The first of a series of war production conferences to exchange information which may be helpful in solving manufacturing problems in war plants was held here May 29. Sponsored by American engineering societies, the meetings are being held at the request of the War Production Board.

WAR ORDERS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

ALUMINUM—Reduction in prices of fabricated aluminum products previously scheduled by Office of Price Administration to take effect June 15 have been postponed until July 1.

FASTENINGS—Prices of bolts, nuts, screws and rivets, with the exception of cap and set screws, are stabilized at levels prevailing October 1, 1941. Prices of cap and set screws are stabilized at levels of June 1, 1941. (Price Regulation 147.)

GRAY IRON CASTINGS—Formula has been issued for determining maximum price for which that price cannot be determined under Section 1499.2. (Order No. 1, General Maximum Price Regulation, Section 1499.3).

INDUSTRIAL EQUIPMENT — No one may accept any order for or deliver any equipment listed in the 14 classes set forth (including elevators, electric motors, fans, pumps) except upon a preference rating of A-9 or higher or upon specific authorization. (Limitation Order L-123.)

INSTRUMENTS—Control has been assumed over the production and distribution of many types of instruments, regulators and control valves used in general industrial processing and in manufacture of war material in order to conserve nickel, chromium and their alloys. (Conservation Order L-134.)

IRON AND STEEL—For 45 days after June 19 fabricated parts may be assembled, but after August 4 all manufacture and assembling of some 400 products listed must cease. (Order M-126.) Application for exceptions should be made on Form PD-437.

IRON AND STEEL SCRAP—Pieces of this scrap 15 in. wide and as much as five ft. long, with some exceptions, may be sold in future as No. 2 heavy melting steel. No change has been made in thickness specifications. (Amendment 5 to Revised Price Schedule 4).

MACHINERY—Production and delivery of heavy boilers, turbines and electrical equipment is limited to orders for war agencies and those rated A-9 or better. (Limitation Order 117).

RAILROAD CARS—Equipment used in construction or repair of such cars may be sold between producers or suppliers of materials regardless of restrictions on deliveries of iron and steel products contained in Order M-21. (Amendment No. 2, Supplementary Limitation Order L-97-a-1.)

SHOT STEEL—For 90 mm. armor-piercing and semi-armor-piercing shot has been placed under complete allocation. (Amendment 1, Supplementary Order M-21-f.)

STEEL DRUMS—Both hot and cold rolled sheets for drum manufacture have been included in reserve allotments. (Amendment 2, Preference Order M-45.)

TANTALUM — Complete allocation control has been placed on this metal. Application must be made by the 20th of each month on Form PD-487 and a report on Form PD-488. (Preference Order M-156.)

TRANSPORTATION — Restrictions on use of closed freight cars in intraterminal movements have been modified to apply only to less-than-carload merchandise which can conveniently be handled by truck. (Order No. 1).

WARTIME WASHINGTON

Manpower commission stumbles at start—no job freezing likely until after election. Joint Army-Navy award for machine tool builders. Lakes freighter built in 48 days

BY BLAINE STUBBLEFIELD

WASHINGTON—Paul McNutt's War Manpower Commission is getting off to a slow and stumbling start. So far it's just a Wednesday Afternoon Discussion Group, has made only the barest beginnings on getting organized. In part this has been due to hazy lines of authority among Deputy Chairman Fowler Harper, Executive Officer Arthur J. Altmeyer, and the new Director of Operations, General Frank J. McSherry. General McSherry—formerly labor supply man for WPB—had been holding off taking the manpower job until he got an ironclad commitment as to his authority. His appointment may mean the period of complete inaction is over.

Spectacular job-freezing announcements can be discounted for the present, and Altmeyer is in the doghouse for starting the stories, which were based on nothing more substantial than inconclusive discussions in the Commission of Detroit labor pirating. Eventually, there's no doubt plants will be required to do all hiring through United States Employment Service or the unions. But it won't come until labor representatives—due to be appointed this week—have given it their blessing. Even then, don't look for it except in a few critical spots until after election.

Meanwhile, what amounts to a system of voluntary priorities in labor is now in effect. U. S. Employment Service offices give first attention to requests for men coming from important war industries. WPB, at Paul McNutt's request, is now preparing lists of plants in order of importance to guide the Employment Service.

Material Supply

Forty items have been added to the Bureau of Industrial Conservation's third report on the supply of materials. The report divides materials into three groups: (1) inadequate for war and civilian use, in some cases even for war alone; (2) essential but less limited materials; (3) materials generally available, many as substitutes for critical items.

In the first group are 25 metals, including copper, aluminum, tin, alloy iron and steel, magnesium, wrought iron, high grade zinc, and practically all of the alloying metals.

Steel is still in the second group, as are gray, cast and malleable iron, aluminum scrap, lead, low grade zinc, and a number of the alloying metals. Steel is listed in this group as bessemer, carbon, basic, and scrap.

In the third group are only four metals: gold, silver, indium, and osmium, plus only six chemicals, and three score such things as asphalt, concrete, glass, gasoline (!) lubricating oil, plywood, stone, wood and products, ceramics. And, thank heaven, those who want a carload of cornstalks or straw can get it.

Great Lakes Program

The Maritime Commission's Great Lakes shipbuilding program to date includes construction of 78 vessels in all, comprised of 16 large ore carriers, 12 coastal tankers, 27 coastal cargo vessels, 5 harbor tugs and 18 seagoing tugs. The first of the vessels were launched June 3 when the Barnes-Duluth Shipyard launched 2 of the 12 coastal tankers it is building. The remaining 10 will be complete by November. The tankers are 220 feet in length and can pass the Welland Canal.

The Oregon Shipbuilding Co. delivered a 10,000-ton liberty freighter 48 days after laying its keel. Recently the company clipped three days off the previous record for liberty freighters by delivering the Mark Twain 56 days after keel-laying. At the same time, their 41st liberty ship was launched after 38 days on the ways.

Bids from 27 contractors for construction of wooden barges without propulsive power were opened by the Maritime Commission, June 1. Barges are to be 180 feet in length and 750 deadweight tons at 11 foot draft. Only 5 barges to a contractor; the first to be delivered in 150 days and the last of each five in 270 days.

British yards are building vessels of over 10,000 tons in 100 days from keel to test. Recently a 14,600-ton deadweight oil tanker has been delivered in eight months from keel-laying. During seven of those months, work had to be carried on in winter blackout conditions, and endless day and night air raids.

Wide World

Plans Tomorrow's World — Milo Perkins, executive director of the Board of Economic Warfare, believes that while winning the war we should be planning the peace, not vaguely but as people who know what we want, and how to attain it

Machine Tool Award

A joint Army and Navy Star Burgee is a new award for machine tool and accessory producers for outstanding production records. Both employees and management are eligible. High speed and quality will be the chief determining factors governing award of the prize. Exceeding production quotas and overcoming obstacles such as shortages of manpower, materials, machinery and space also will be considered. "This award is not readily given nor easily earned," says the War Department's announcement, but the Services hope that many plants will earn the privilege of flying the flag, which is blue, with a white star in the center, and the words Army and Navy in large red letters, edged with white piping. All workers get a button.

No. 136 Postponed

The Office of Price Administration announces that the effective date of maximum price regulation No. 136 on machines and parts has been postponed from June 1 to July 1. It was set ahead once before, from May 18 to June 1.

OPA announces that "An extensive and extremely important" amendment to No. 136 is being written, and that the order should not take effect till the details of this amendment are distributed and known to all concerned.

No. 136 covers most machinery and parts not covered by other regulations. Machine tools are otherwise covered, and a great many completely assembled combatant items for Army, Navy, Maritime Commission are excluded from the General Maximum Price Regulation by Supplementary Regulation No. 4.

Make Every Minute Count—The management-labor production drive committee at Pratt & Whitney, Division of Niles-Bement-Pond Co., plans a joint drive to increase output of machine tools, small tools and gages. Members from each department build an active program to make every man feel his importance as a production soldier. Posters, slogans, employee suggestion boxes will be used

NAMES in the NEWS

Herman W. Steinkraus, vice president and general manager of the Bridgeport Brass Co., has been appointed president to succeed Ralph E. Day who has resigned because of ill health. Mr. Steinkraus joined the organization in 1928 and became general manager late last year.

William P. Gwinn has been named assistant general manager of Pratt & Whitney Aircraft Div. of United Aircraft Corp., East Hartford, Conn. Mr. Gwinn started with the company in 1927 and has been assistant sales manager of Pratt & Whitney for the past two and one half years.

C. F. Pittman, manager of the motor division of the industrial department of General Electric Co., has been appointed assistant to the manager of the industrial department. W. H. Henry, formerly manager of sales in the motor division, has succeeded Mr. Pittman as manager of the division.

Roy T. Wise, deputy machine tools controller, Department of Munitions and Supply, Ottawa, has been appointed director general of the Gage and Cutting Tool Production Branch.

J. A. Elwood, formerly division superintendent of Nash-Kelvinator Corp., has been made general works manager of the George Gorton Machine Co., Racine, Wis.

A. L. Kress, recently consultant to the member companies of the Aeronautical Chamber of Commerce on job evaluation problems, has become assistant to the president of Republic Aviation Corp., Farmingdale, L. I.

Benjamin T. Salmon has been promoted to chief engineer of the Ryan Aeronautical Co., San Diego. He has had wide experience as design engineer on some of the country's foremost airplanes.

George Kentis, Jr. has been advanced to the position of chief engineer of the Yoder Co., Cleveland, from that of superintendent of the Boring Mill Division which he has held since the early part of the war effort.

Arthur W. Kimbell, who has been vice president and general manager of United-Carr Fastener Corp. for the past fourteen years, has been appointed president.

Robert L. Coe, vice president of Chase Brass & Copper Co., Waterbury, Conn., was elected president of the Copper & Brass Research Association at its twenty-second annual meeting. He succeeds John A. Coe, president of American Brass Co.

William C. Johnson has been announced as general sales manager of Allis-Chalmers Mfg. Co.

Edward G. Haven has been appointed manager of sales of the aviation division of the industrial department, General Electric Co.

H. Sturgis Potter, of the Indianapolis branch of Carpenter Steel Co., has been transferred to the main office at Reading as assistant manager of tool steel sales.

Robert C. Onan of Lindberg Engineering Co., Chicago, has been appointed district sales manager with headquarters in Milwaukee at 606 W. Wisconsin Ave.

James A. Herrington has been made president of Knu-Vise, Inc., Detroit, He joined the organization in 1939 as general manager and was formerly assistant superintendent of the body plant of the Freuhauf Trailer Co.

F. B. Davis has been named Buffalo district manager for Copperweld Steel Co. He was previously connected with the Edgar T. Ward Co.

Paul Hacker has joined the Pioneer Engineering & Mfg. Co., Detroit, as pump engineer in charge of sales. Formerly he was associated with the Packard Motor Car Co. for twenty-seven years.

H. J. Mokate has been appointed assistant to vice president, Scully Steel Products Co., Chicago.

Ivan Anderson has been made assistant chief of the Special Industrial Machinery Branch, WPB.

OBITUARIES

A. E. Crockett, 69, special sales representative, Jones & Laughlin Steel Corp. died after a short illness. He was associated with the company since 1915, and devoted most of his time to educational work and lecturing on the manufacture of iron and steel products.

Clarence A. Esslinger, manager of Burchall Products, Inc., New York, and former automobile executive died recently.

Harry F. Ellis, 64, vice president of White Tool & Supply Co., Cleveland, died at his home in that city.

MEETINGS

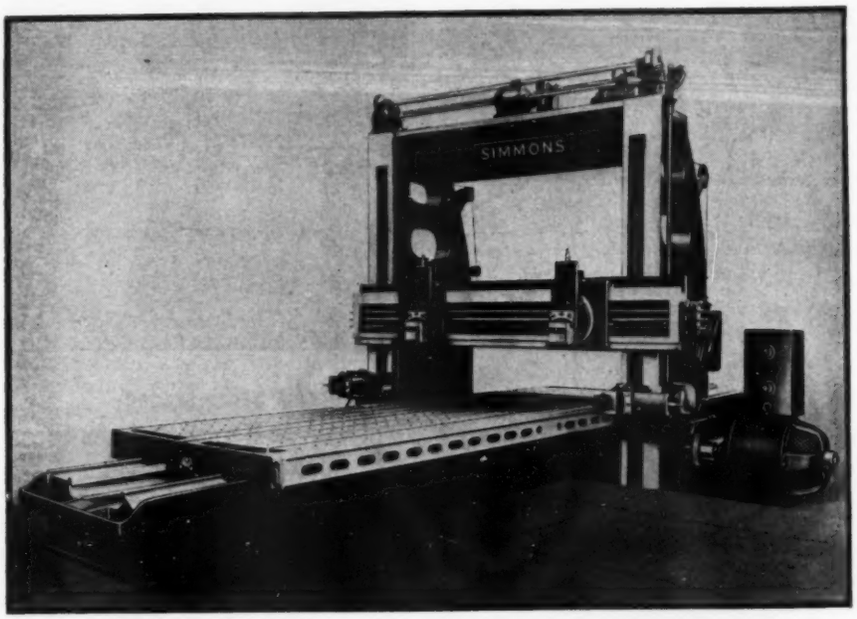
American Management Association. National industrial salvage conference. Hotel Astor, New York, N. Y. June 17.

American Society for Testing Materials. Annual meeting. Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26.

National Industrial Advertisers Association, Inc. Annual meeting. Traymore Hotel, Atlantic City, N. J. Sept. 23-25.

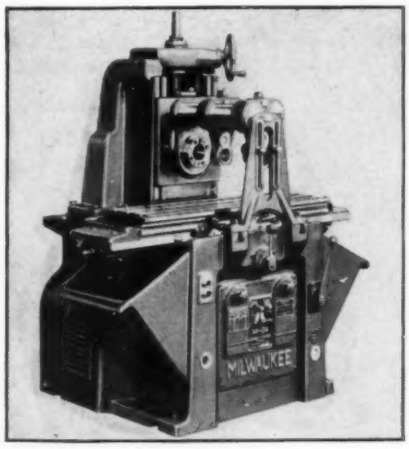
SHOP EQUIPMENT NEWS

Simmons Planer Has Power Rapid Traverse To All Heads Operating Through Special Clutches



Features of the 96x120 in. heavy duty planer announced by Simmons Machine Tool Corp., North Broadway, Albany, N. Y., include power rapid traverse to all heads, operating through specially designed clutches; double-length inclosed bed provided with forced feed lubrication to the ways and double-plate box table that does not extend beyond end of the bed even at its maximum stroke; herringbone gear drive for smooth flow of power; ball thrust bearings on rail and sidehead feed screws; adjustable taper grips throughout; micrometer collars for horizontal and vertical feeds and power elevating device for rail.

The inner guide box table has one flat and one V-way which rides constantly on a film of oil delivered by pump into the bed channels for the entire length. The bottom side of the table is entirely closed, and heavy ribs at short intervals tie the top and bottom securely together. Tables are available in lengths of 20, 24, 30 and 34 ft.



Simplex Milwaukee Millers ← Have Heavy Model Features

Models M-18, M-24 and M-30 Simplex Milwaukee milling machines, built by Kearney & Trecker Corp., Milwaukee, Wis., are capable of economical and efficient production of thousands of small, medium sized parts and incorporate the basic design features of the heavier 1200 and 1800 series. These machines may be had with either 18 in., 24 in. or 30 in. of power table feed; tables are 13 in. wide and 34 in., 40 in. and 46 in. long respectively. Three optional feed ranges with climb milling screw can be furnished—¼ in. to 10 in. per min.; ½ in. to 20 in. and ¾ in. to 30 in. Each range has 16 feeds effected by pick-off gears. Spindle drive gears are solidly mounted in the spindle head and the quill has 4 in. of cross adjustment. The spindle end is a No. 50 National Standard.

Standard equipment includes spindle reverse, mechanical screw feed with hydraulically controlled clutches for automatic, two-way table cycle, two arbor supports and eight pick-off speed gears and eleven pick-off feed gears. Machines are driven with silent V-belts using a 50 hp., 1,800 r.p.m. motor.

Essential Milling Work Done on Jefferson Miller

Die sinking, contour profiling, angular milling, jig boring, routing of ferrous and non-ferrous metals, and practically all other essential milling operations

can be performed economically on the motor-driven "bull-dog" high speed precision milling machine built by Jefferson Machine Tool Co., Fourth, Cutter and Sweeney Sts., Cincinnati, Ohio. This machine is available in a floor type, No. 200F, or a bench type, No. 200B. The table has three ½-in. T-slots fitted with friction feed. The power feed, furnished with adjustable positive automatic stop, has a three-

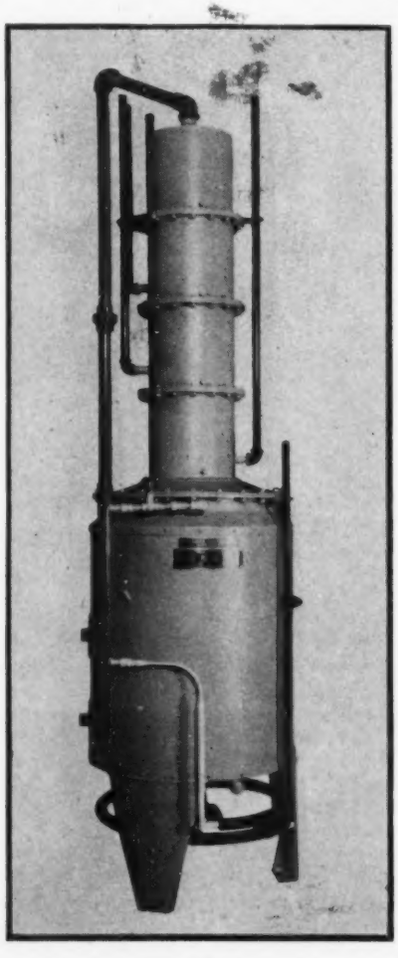
step V-belt drive for each of the four spindle speeds; 200, 400, 700 and 1,000 r.p.m. A quick adjustment lever maintains constant maximum pulling power of V belts and automatically releases itself in case of overload. The machine is so constructed that it is at all times ready for the application of a variety of standard attachments. The longitudinal feed of table is 8 in., traverse feed 3 in., vertical motion to knee 5¾ in., maximum distance from center to table 5¾ in., working surface of table 14 × 4⅝ in. and height over all of the floor type is 52 in.

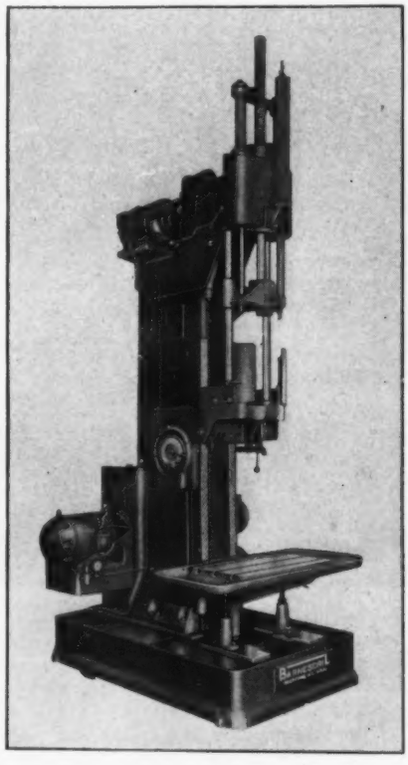
Niagara Blower Develops Cold Room Conditioners

Cold room air conditioners which provide constant temperature as low as —50 F. to —80 F. have been developed by the Niagara Blower Co., 6 E. 45th St., New York, N. Y., for use in experimental laboratories and by manufacturers required to test or normalize parts, materials and machinery at such temperatures.

This equipment consists of coolers operated in stages, the first stage reduces to temperature just above the freezing point of water and removes humidity; the second uses the Niagara "No Frost" method to remove the balance of the moisture, and the third produces and holds the required final temperature.

By the "No-Frost" method, which employs a special non-freezing liquid continuously reconcentrated in a Niagara concentrator designed especially for this duty, moisture is removed from the air below 32 F. without causing formation of ice on coolers. This method provides fresh make-up air at correct low temperatures in rooms large enough for full scale testing.

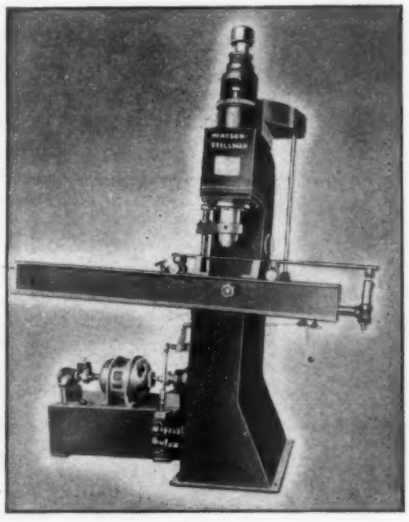




Barnes Self-Oiling Hone Designed For Aviation Work

Barnes Drill Co., Rockford, Ill., has developed the No. 307 self-oiling hydraulic honing machine which is suitable for aviation work as well as other essential honing requirements. It hones bores up to 6½ in. inside diameter. Standard spindle travels in the four models available range from 25 to 45 in., and separate motors are used for rotations and for reciprocations of the spindle. Single speed or six speeds are available. Push button control station starts and stops both motors. The "inching" button intermittently starts the cycle which provides power for hydraulic reciprocations thus gradually lowering the hone into the cylinder without rotation. By pressing the "start" button the hone reciprocates and rotates in the bore. Readily accessible pick-off gears provide means for changing speed of spindle rotation to any desired rate within the capacity of the single speed machine.

The over-all height of each of the four models is 144, 159, 174 and 204 in., occupying floor space of 76½ × 60 in. The size of the plain rectangular table is 17 × 30 in., while in and out hydraulic travel tables for long or heavy honing work measure 30 × 30 in.

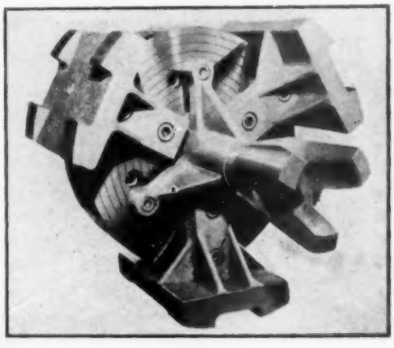


Gun Barrels Straightened In Watson-Stillman Press

An improved 50-ton press, developed for finish straightening gun barrels by The Watson-Stillman Co., Roselle, N. J., incorporates positive stop adjustment controlled by a handwheel and is mounted on an angle base to facilitate sighting along barrels being straightened. The press is also suitable for straightening structurals. It has a 12 in. opening, 10 in. gap and 9 in. stroke. Its table is 6 ft. long by 11½ in. wide. Ram diameter is 8 in. Control is by a single hand lever. Power is furnished by a 7½ hp. motor, operating the press through rotary vane type pumps. Complete unit weighs 7,250 lb., stands 11 ft. 6 in. high and requires 6 × 3 ft. floor space.

Airgrip Chuck Used To Machine Thin Wall Flasks

The Anker-Holth Mfg. Co., Chicago, Ill., has announced the "Airgrip" chuck used for machining thin wall flasks. Forged steel flasks 21 in. in diam. and with walls only ⅜-in. thick can be ma-



chined to 0.010 in. tolerance on the outside diameter with this equipment. The 24-in. locator is mounted on a 15-in. 3-jaw universal chuck. The jaws have 1 in. stroke and expand 1 in. in the flask. Twelve pads prevent distortion of the wall. A special feature of these chucks is matched false jaws that are balanced to within ¼ oz. The weight of the chuck is 464 lb.

Filter Serves Three Air Tool Operations

A two- and three-outlet filter for serving two or three air tool operations at one point has been added to the line of Filters, Inc., Glendale, Calif. The three-way manifold air filter illustrated was developed in collaboration with Burklyn Corp., Glendale, Calif. The CCA (conditioned compressed air) filter prevents harmful dust, rust scale, oil and water entering air tools and prolongs life and efficiency of pneumatic equipment. Centrifugal action of the air within the filter removes 90 percent of the dirt and moisture and the balance is filtered out by a special wool-felt glove. For cleaning, the water and dirt are blown out of the drain valve at the bottom of the bowl and filter may be completely dismantled without disconnecting from the line.

Portman Surface Grinder Is Powered to Remove Stock Fast

Several advanced design features have been incorporated in the rotary type surface grinder announced by the Portman Machine Tool Co., 19 Beechwood Ave., Mount Vernon, N. Y. It is amply powered to remove stock fast and to the exacting accuracy and finish requirements. The machine is of unit type construction consisting of a heavy box-type base containing the entire coolant system, rugged well-proportioned motor head column, roller-mounted column sub-base, and fixed magnetic rotary chuck drive assembly which is incorporated in the base.

The main drive of the grinder consists of a totally inclosed 7½ hp. motor with which the entire precision spindle head is integrally mounted. The motor head and column assembly is adjustable for grinding concave and convex as well as flat surfaces.

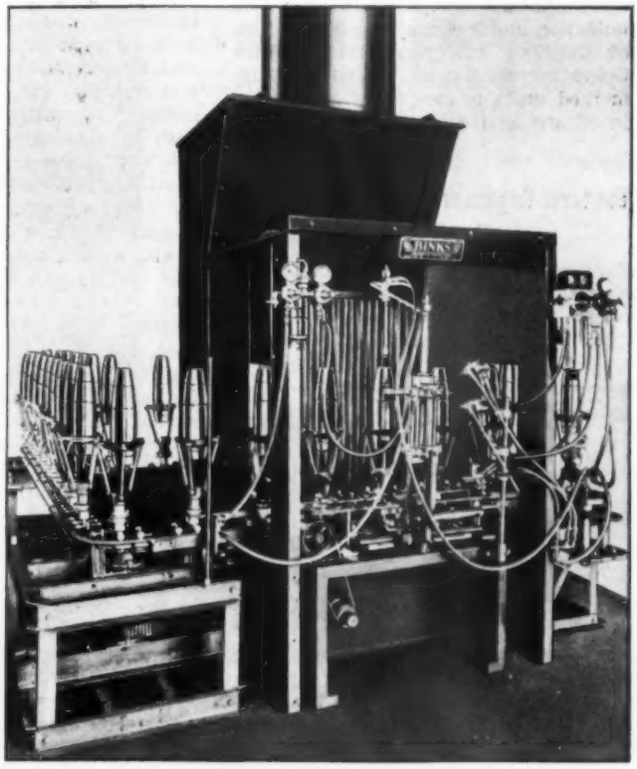
Five speeds are furnished on the magnetic chuck drive for all classes of work. The 12-in. magnetic chuck provides a capacity for grinding parts as large as 14 in. in diameter and 9 in. high under a new wheel.

The motor coolant pump is of the unit type, providing a large volume of coolant directly to the work and grinding wheel.

This surface grinder occupies a floor space 3 × 7 ft., and stands 5 ft. 9 in. high. Standard equipment includes two cup type grinding wheels, all motors, motor controls, magnetic chuck, complete coolant system, demagnetizing switch, and splash guards.

Binks Shell Machine Sprays Inside and Out Automatically

An automatic spray finishing machine for spraying the inside and outside of 75-mm. to 105-mm. shells has been announced by Binks Mfg. Co., Automatic Div., 3114-40 Carroll Ave., Chicago, Ill. The shells are loaded on a moving conveyor in a specially designed workholder which holds them in place. As these pass in front of the water wash spray booth an oscillating mechanism engages the spindle of the holder, rotating the shells in front of the automatic spray guns which spray the exteriors. The shells then pass to the position where a pneumatic spray gun plunges down into the interior cavity of the shell as it rotates and completely sprays the inside. They then move

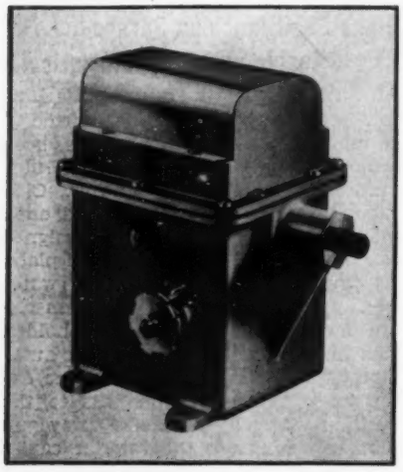


away from the oscillating mechanism and continue on the conveyor for the time required to complete an air dry and then unloaded.

The machine is equipped with a "Skip Spray" unit which has been so designed that the gun will not spray if a shell is missing on the conveyor. Thus no paint is wasted or lost in the process.

Barber-Colman "Microtrol" Operates Butterfly Valves

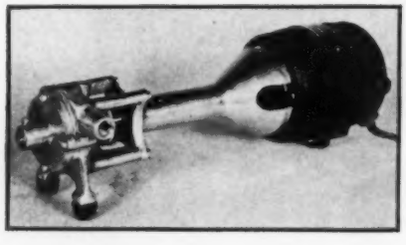
For operating butterfly valves, multiple ratio fuel valves and regulation of dampers in air conditioning and drying systems the Barber-Colman Co., Rockford, Ill., has introduced a unit called "Microtrol." Features include a high torque proportioning control motor with



built-in limit switches and potential dividing rheostat. Output shaft is driven by the company's shaded pole induction motor through gear reduction of machine cut, heat-treated gears. Operating mechanism of the oil-submerged units is completely submerged in oil and sealed in a die cast case.

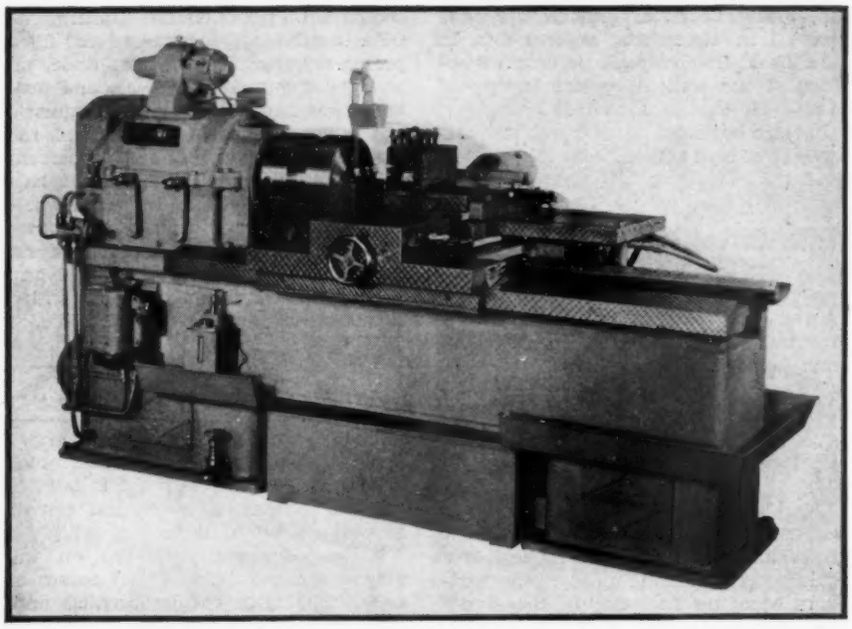
Eastern Engineering Pump Handles Heated Liquids

Eastern Engineering Co., 45 Fox Street, New Haven, Conn., announces a small pump for hot liquids, up to 500 F. The pump is centrifugal and is



12×4×4½ in. Motor and pump are coupled to a 5 in. heat radiating tube. Maximum volume is 7½ gal. per min., and maximum pressure 21 lb. per sq.in.

Four Norwood Lathes Handle Shell Turning; Multiple Tooling For 50 to 155 mm. Sizes



A multiple tooled, fully hydraulic, automatic lathe for turning shells is being manufactured by the Norwood Engineering Co., 95 N. Maple St., Florence, Mass. Four standard models of hydromatic lathes are available for different operations in turning shells from 50 mm. to 155 mm.

Model ST-1, for centering and cutting off the shells, has a carriage on which is surmounted a rest on which are solidly mounted a motor and center drill.

Model ST-2, for the rough turning operation, is equipped with a heavy duty tailstock of close-grain cast iron, and the revolving spindle is high-carbon steel, ground, with a No. 5 Morse center. In addition to the carriage with an exceptionally long bearing on the ways, there is a cross-slide at the front equipped with three tool holders for roughing tools and a unique arrangement for a boattail tool. There is also a back tool slide equipped with one tool holder for the back facing tool.

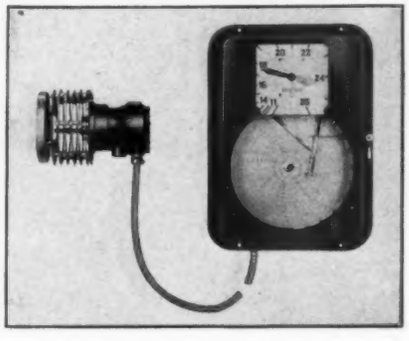
Model ST-3 takes care of boring the nose and rough facing, rough reaming, finish reaming and facing. Surmounted on the carriage of this model is a hexagonal turret with all faces bored and tapped for mounting tool holders. The turret is quickly and easily indexed manually and the indexing is always positive.

Model ST-5, shown in the illustration, is for cutting off and finishing the base of the shell, and for cutting the band groove. This model has a carriage in a fixed position on which is mounted a cross-slide with one tool holder, and a back bracket on which is mounted a back tool slide with two tool holders.

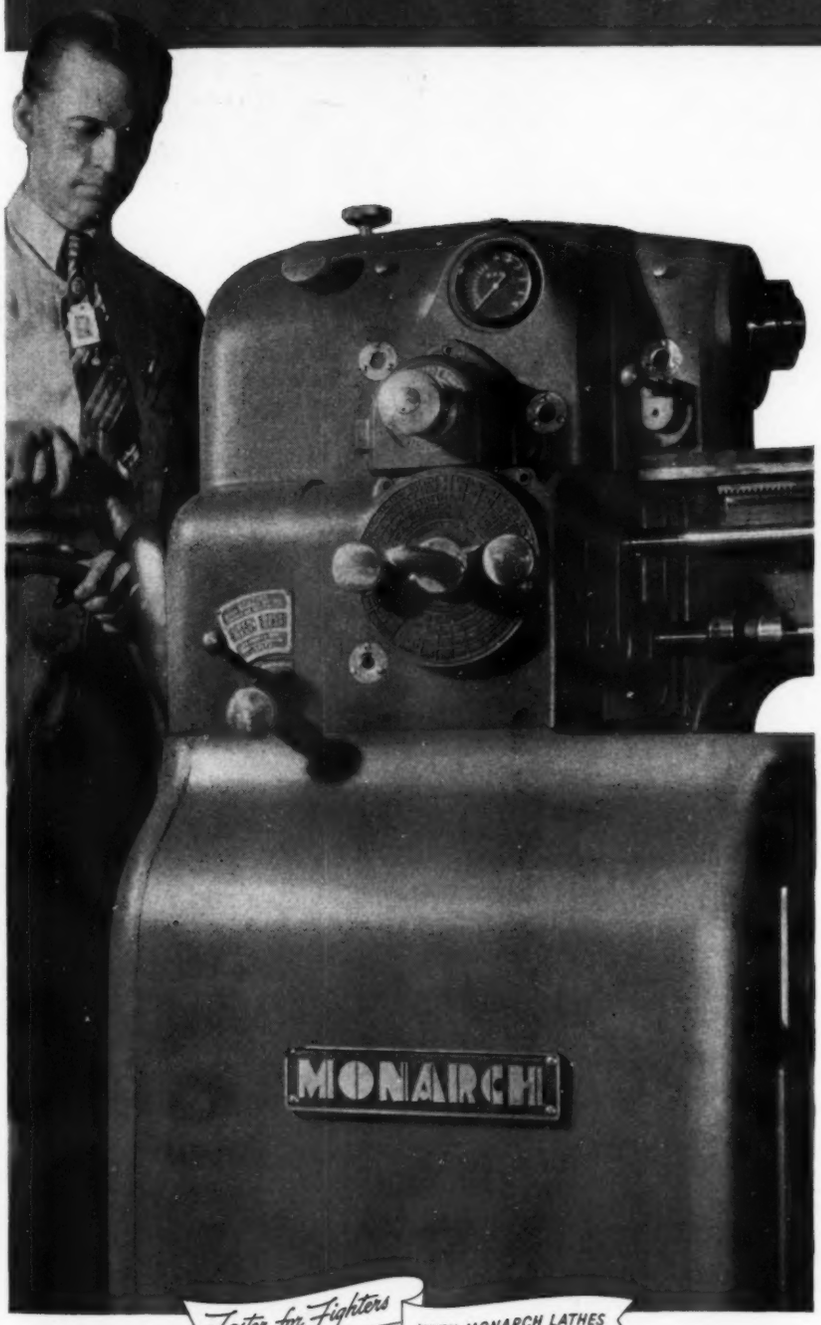
Modern features of the hydromatic lathe include: Barnes patented system of hydraulic transmission and control; the Bijur oiling system; driving through a Link-Belt silent chain from the motor to the back gear shaft; interlocking of the main drive motor with the hydraulic feed mechanisms; hydraulically controlled feeds with infinite variation; a rugged headstock with a carefully worked out gear arrangement; Timken radial thrust roller bearings; and an extra heavy bed and pedestals. The lathes have 8 ft. and 10 ft. beds.

Bristol 'Pyrovac' Measures High Furnace Temperatures

A radiation pyrometer known as the Pyrovac has been introduced by the Bristol Co., Waterbury, Conn., and is designed for recording, indicating or automatically controlling temperatures in furnaces and kilns above 900 F. The temperature-sensitive unit or radiation head is mounted on the outside of the furnace out of the hot zone where it picks up heat rays emitted from the object under measurement. The instrument is intended for use in measuring and automatically con-



WE'VE PUT ON "War Paint"



INDIAN WAR PAINT in brilliant colors gives way to today's program of stripping all nonessentials from our War effort. Complying with instructions from the War Production Board, Monarch and other machine tool builders are eliminating everything except protective painting, to save materials, man-hours and to quicken deliveries.

But under this changed surface, Monarch lathes perform just as efficiently as always. They are up in the front lines of our production effort, taking the burden of continuous operation in many plants—helping to deliver the implements of Victory, *faster for fighters.*

We promise you that when Victory is won and restrictions are lifted, we'll again make your Monarch lathes as handsome in their peacetime appearance as they will be useful in their peacetime performance.

THE MONARCH MACHINE TOOL COMPANY

SIDNEY · · · OHIO

Faster for Fighters WITH MONARCH LATHES

MONARCH LATHES

COVER THE TURNING FIELD

trolling high temperatures out of the range of the thermocouple, temperatures for which rare-metal thermocouples are used, surface temperatures such as roof, wall, duct, lining and temperature of the work itself, also where the object is moving or where there are space limitations.

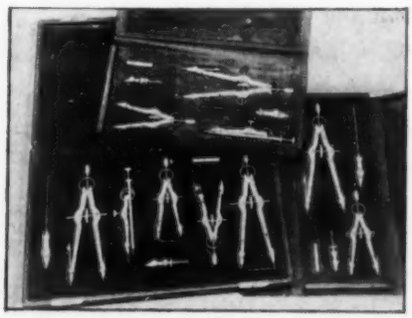
Universal Indexing Head Fits Any Tool or Surface Grinder

The universal precision indexing head announced by the Cleveland Tool Engineering Co., 9205 Detroit Ave., Cleveland, Ohio, can be used on any tool or surface grinder. It is graduated

360 deg. and will handle every simple or compound angle.

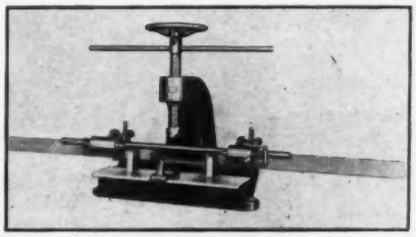
The vernier lever rotates the work collet between index points without changing index or location of the tool in the collet. Aviation ball bearings carried on the collet quill reduce friction for spirals.

Standard equipment includes one standard Hardinge collet. The head is easily fitted with straight or taper shank or 3-jaw universal chuck.



Open Truss Design Bows, Pens Announced By Vemco

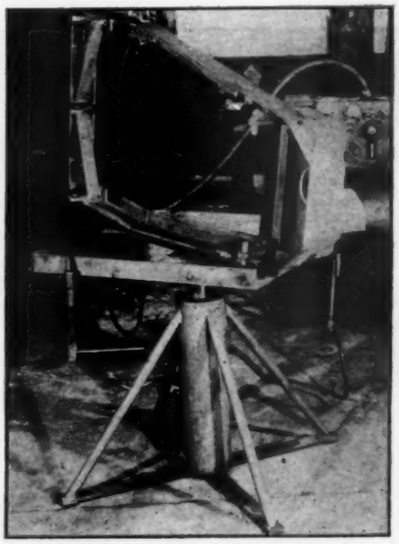
Three combinations of bows, drop bows, and pens are announced by V & E Engineering Co., Pasadena, Calif. Vemco instruments embody unique features of open truss design which increases strength and rigidity while cutting weight. Rigidity combined with absolute concentricity enables user to describe extra-large, dense circles in pencil without the instrument yielding. Each bow has a center-screw adjustment which articulates with the legs by cylindrical nuts. The legs bear upon a double-grooved hinge pin of broad base, assuring strength and perfect alignment. Construction is of steel, satin-chrome plated. Sets are available in one, two, and three bow combinations complete with dividers and pens, packed in velvet-lined leather cases.



General Hand Screw Press Straightens Shafts, Parts

Announcement of a No. 5 hand screw straightening press equipped with a No. 76 lock lever center type shaft straightening attachment has been made by the General Mfg. Co., Detroit, Mich. It is also available with a No. 36 roller V-type shaft straightening attachment.

This press has a 12-in. opening, 9-in. stroke, 5-in. throat with table 8 × 30 in. extending 5½ in. in front of center line of screw. The straightening attachment track length is 85 in.



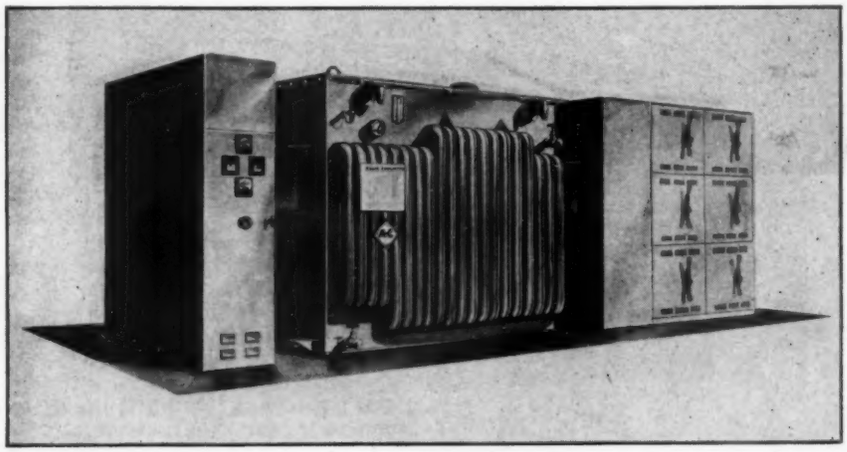
Lyon-Raymond Welding Table Equipped With Revolving Top

Lyon-Raymond Corp., 930 Madison St., Greene, N. Y., offers a hydraulic elevating welding table with a revolving top. It serves the purpose of a welding positioner in many instances. By means of a foot-operated hydraulic pump the operator can keep the work at the most convenient height and because of the revolving top the table can be adjusted to the desired position. The standard stock size of table has a capacity of 2,000 lb., platform sixe 30 × 30 in., lowered height 26 in., elevated height 40 in., elevation 14 in. Although mounted on a floor base rather than on casters the table is portable.

Allis-Chalmers Substation Saves Headroom, Floor Space

The standardized load-center unit substation announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis., can be installed anywhere in the plant or power distribution centers, saving valuable headroom, floor space and long secondary runs of heavy copper. Because of extreme flexibility the substation offers a wide choice of incoming- and outgoing-line arrangements. It consists of a metal inclosed incoming-line section, a throat-connected transformer and a low voltage feeder section.

On the high voltage side potheads, disconnect switches, oil fuse cutouts, metal-clad switchgear or direct connection through terminal box can be sup-



GIVING *Wings* TO PLANE PRODUCTION

TOOL LIFE INCREASED 33%... ACCURACY AND FINISH IMPROVED *with* SUNICUT

Excessive heat and short tool life hindered production in this manufacturing plant making vital parts for combat planes. Cutting oil needs were surveyed . . . Sunicut recommended. Now work runs cooler, tool life has increased 33%, finish is improved, closer accuracy obtained — all adding up to greater output per machine unit.

This report of a Sun Oil Engineer — one of those capable "Doctors of Industry" — is typical of the service they and Sunicut are rendering to our vast war industries.

Sunicut, a clear, transparent sulphurized cutting oil, takes the heat *off* tools and work . . . puts it on production. Sunicut's transparency permits ready micrometer readings . . . easy maintenance of close tolerances.

Sun Engineers stand ready . . . willing and able to help you in your own plant. Their services . . . and the products they offer . . . are yours to use in attaining victory production. For helpful case histories of how they have aided other leaders in the metal working field, write for your free copy of "Helping Industry Help America."

SUN OIL COMPANY • Philadelphia, Pa.

Sun Oil Company, Ltd., Toronto

LET'S GO! U.S.A. KEEP 'EM FLYING!

SUNOCO

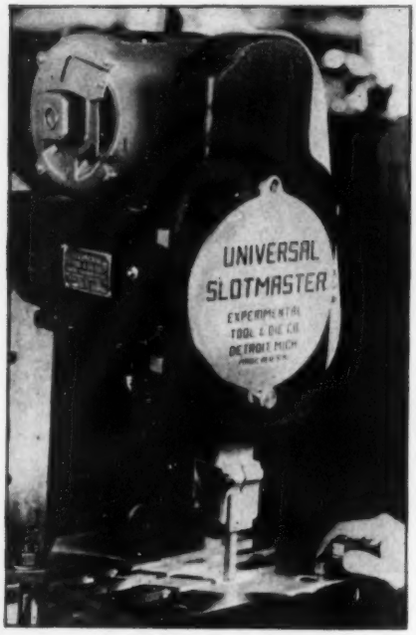
SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

plied. Stationary or drawout air breakers, electrically or manually operated are furnished on the low voltage side.

Complete inclosure, uniformity of appearance, absence of exposed leads, buses and splices make this substation a compact and attractive installation. It is available for either indoor or outdoor service, and sizes ranging from 100 to 2,000 kva.

Intricate Teeth Cut In One Set-Up With "Slotmaster"

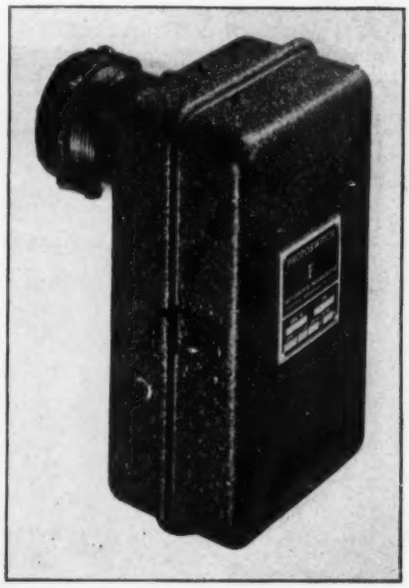
Intricately shaped teeth of chuck jaws can be cut accurately using one set-up with a slotting head attachment, the "Slotmaster", mounted on a round or flat-on-round overarm milling machine. This attachment was developed



by the Experimental Tool & Die Co., 12605 Greiner, Detroit, Mich. The jaws are chucked on a rotating table on the milling machine. A slotting tool is ground to the shape required and inserted in the clapper box tool holder of the slotter. When one row of teeth is completed the work is indexed to the next position, and so on, until the teeth are finished.

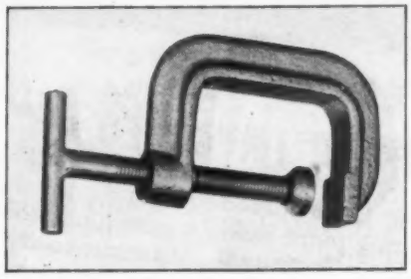
Photoswitch Develops Factory Alarm Control

A photoelectric control for the purpose of providing a warning signal inside factories in the event of an air raid has been developed by Photoswitch Incorporated, 21 Chestnut St., Cambridge, Mass. The Photoswitch control is placed in a convenient location so that it views a centrally controlled street lamp. Through the instrument are connected alarm systems operating inside the factory and when the street lights are turned out the alarm is sounded. The control is designed to operate independent of a momentary flickering of the street lamp and of ambient light conditions. Photoswitches are also available for controlling all types of outdoor illumination, signs and window displays.



Non-Skid C-Clamp Built By Patterson-Ballagh

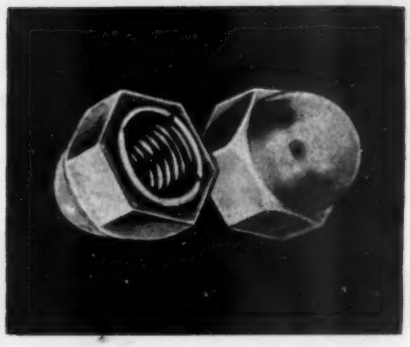
A different type of C-clamp with non-skid features which prevent skidding when tightening has been designed by Patterson-Ballagh Corp., 1900 E. 65th St., Los Angeles, Calif. The clamp tip is equipped with a bronze bushing in which the end of the screw rotates. The screw is made of heat-treated steel. This bushing prevents galling



and provides a free movement so that slippage on work is prevented. The frame is made of cast steel, also made with terminal lug for use on grounding cable during arc welding. A welded T-shaped wrench handle allows a firm grip.

Acorn Shaped Lock Nuts Made By Laminated Shim

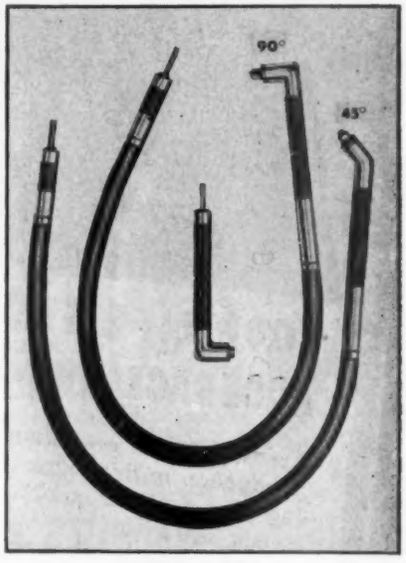
Cap (acorn) shapes are now available in An-cor-lox lock nuts manufactured by Laminated Shim Co., Inc., An-cor-lox Div., Glenbrook, Conn. They are of all-metal construction and self-contained, the locking ring being made integral with the nut body; comprising a single-unit lock nut.



The cap nuts will be made up to specifications required and a wide choice in materials for the nut body is offered; also considerable variation in the metallic composition of the locking ring insert. All standard sizes (measured by bolt diameter dimensions) are listed; obtainable with thick or thin walls.

Stow Flexible Shaft Unit Has 45, 90 Degree Drills

For difficult drilling in spots hard to reach the Stow Mfg. Co., Inc., Binghamton, N. Y., has announced flexible shaft units with heavy duty 45 and 90 deg. angle drills. They are gear-driven, full ball bearing type and permanently



attached to the flexible shaft. Spindle heads are threaded for adapters, ¼-28 thread, accommodating either stub or full length drills up to No. 30 size. Clearance distance from drill center to outer surface of angle head housing is ⅜ in.

Force Interchangeable Die Marks Instrument Dials

An interchangeable die for marking aircraft instrument dials has been designed by Wm. A. Force & Company, 216 Nichols Ave., Brooklyn, N. Y. It

COPYRIGHT 1942 — JONES & LAUGHLIN STEEL CORPORATION

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

SKILLED CREWS SET A FIGHTING PACE PRODUCING WAR STEELS

Like the Navy in action, crews of skilled men are setting a fighting pace in the production of fighting steels. Broadsides that flare against the sky, night and day, tell that here in the steel works a battle is being waged and won — for it is on the home front that tools for victory must first be forged. These men of steel know their first-line duty is working on the important job of making steel — the job that years of experience and skill fit them to do. In all divisions, all departments, men and management also know that the more steel produced and delivered now — every hour of every day — the earlier the enemy will be defeated. So they do their fighting by producing steel for planes, tanks, guns, ships and shells at a pace that breaks all records and breaks them again and again.

Thousands of J&L employees are buying War Bonds on voluntary allotment plan. In many divisions subscriptions have reached 100%

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON & STEEL WORKS • PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

Picture above was taken in a mid-western plant, where difficult production filing of machine gun stripper links and cartridge stops is done faster and better with DoAll Band Files.

• Since Pearl Harbor, DoAll Band Files, perfected long ago for high quality peace-time filing, are now on regular war schedules in hundreds of plants, turning out needed materials for army, navy and air corps.

SEE HOW DoAll File Bands WORK

DoAll Band Files are 8 times as fast as hand filing, 5 times as fast as jig filling. Operating in one direction only, they last twice as long as 2-way stroke files.

LARGE ASSORTMENT

There are 23 sizes—a width, cut and style to take care of anything from high carbon steel to hard rubber

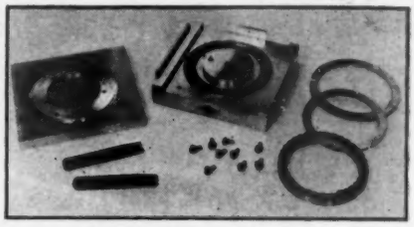
Send for new File Booklet today.

THE DOALL COMPANY

1210 Thacker St. Des Plaines, Ill.

Associated with
Continental Machines, Inc., Minneapolis, Minn.

does a precision numbering job on aluminum at the rate of approximately 240 pieces per hr. The interchangeable type provides for replacing single characters or resetting all characters with ease and speed. Die-holder rings are



changeable. The same die may be used to mark different dials or to mark the same dial with different spacings. The die is assembled in a hydraulic press and the aluminum dials are fed by hand and stacked with protective spacers between each piece to avoid scratching or bending.

Swartz & White Grinder Has Positive Belt Tension

A model S-4 series grinder has been announced by Swartz & White Mfg. Co., 215 Washington St., Binghamton, N. Y. It is fully equipped with ball bearings, giving four speeds with V-belt. Countershaft construction permits positive belt tension at all times and rapid change of belt speeds.

The grinder has been designed to operate where floor models cannot be used, such as trolley, ceiling or bench mounting, and is furnished in ¼ to 1 hp. sizes.

Binks Can Adapter Fits Most Standard Paint Cans

Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill., has introduced the L-367 can adapter which fits most standard paint cans. By simply placing the equipment on top of a can and tightening the lever which clamps on the inside of the adapter the cup is ready to fit into the yoke of the standard spray gun attachment. The ears fit into the openings on the yoke, and by turning the tightening lever on the lid the gun is ready to use. The adapter can be readily moved from can to can as desired.

Plastic Spacers For Milling Show Thickness By Color

Plastic spacers which save brass and steel are produced by Artus Spacers, New York City, for use in milling machine operation. The spacers are made in ten thickness from 0.001 to 0.020 in., with hole diameters as high as 2 in. with standard keyways. Each thickness has an identifying color, eliminating the necessity of micrometer-caliper measurements. The spacers

are made from "Plastacle" cellulose acetate plastic, produced by du Pont, and are said to retain their thickness under all normal working conditions.

Closer Tolerances Held In Vernon Vertical Jig Borer

In addition to closer over-all tolerances in construction of the Vernon vertical mill and jig borer, improvements have been made in rigidity and operating accuracy by the Machinery Manufacturing Co., 1915 E. 51st St., Vernon, Los Angeles, Calif. Micrometer depth stops provide greater accuracy when drilling or boring to predetermined depths. Gib locks and independent quill lock as well as the longitudinal table stop are among the features incorporated.

Whiting Unit Suppresses Dust, Fumes by High-Velocity Impact

The Whiting Corp., Harvey, Ill., has introduced a line of dust and fume suppression equipment for every type of foundry and industrial application known as "Hydro-Clone." The unit effectively suppresses dust and fumes by a simple process of disintegration in which dust and fume laden air mixed with water is subjected to high-velocity impact. Eight different designs are available, including grinding and polishing booths and spray cleaning booths.

Blackmer Rotary Pump Uses Bucket Design Principle

The bucket design principle has been incorporated in a new vertically mounted rotary pump produced by Blackmer Pump Co., Grand Rapids, Mich. A wide range of liquids, varying in viscosities from tar to naphtha, may be handled in this pump. It is self-adjusting for wear, and an important feature is the fact that when the buckets are completely worn out the unit may be restored to its original efficiency by simply removing the head and replacing with new buckets, requiring only about 20 min. to complete.

The capacity of the pump is 150 g.p.m. at a pressure of 100 lb. per sq.in. and is powered by a 15-hp. 300-r.p.m. gearhead motor on the pump shaft. The same type is also furnished in capacities from 5 to 700 g.p.m. and in pressures up to 300 lb. per sq.in.

Wiremold 'Raceway' For Simple Electric Wiring

A simplified network type of electric wiring installation utilizing basic Wiremold 3000 raceway has been announced by the Wiremold Co., Hartford, Conn. It can be used to provide complete surface wiring layout for lighting and portable tool or appliance power outlets in production areas, engineering departments and laboratories.

The rigidity of channel and special

LUFKIN

MICROMETER DEPTH GAGE

QUICK, EASY, ACCURATE READING

Whenever you need to check the depth of holes or slots you can't beat a Lufkin Micrometer Depth Gage for all-around convenience and accuracy.

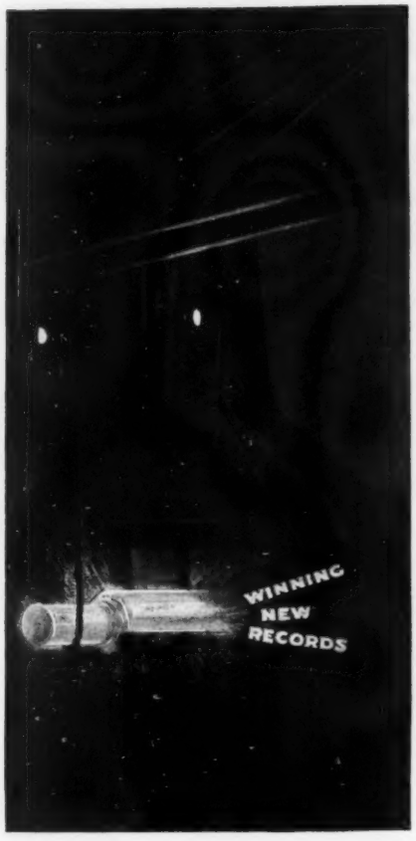
Each gage is provided with three rods (5/32" diameter) which permit measurements from zero to three inches by thousandths. Additional rods are available for measuring up to 6 inches. Adjustable nut to compensate for wear. Patented lock nut locks the rod at any desired point, maintaining reading and often preventing errors. Available with 3" or 5" base, knurled surface on top affording the firm hold essential for accurate measurements. See your dealer and write for complete Lufkin catalog.

BUY THROUGH YOUR DISTRIBUTOR

LUFKIN

SAGINAW, MICHIGAN · NEW YORK CITY

TAPES · RULES · PRECISION TOOLS



Forge Shop
Improves Cutting 50%

BEFORE this Mid-Western forging concern swung to Capewell's TECHNITE power blades, they ran a test. Results showed Capewell "cutting 50% better" than the blades previously used. Again Capewell sets a new record. Another piece of testimony backs up our statement that Capewell precision-cutting hack saw blades *cut costs*—because their breakage is smaller, because their sawing is faster. In addition, the accurate, precision cutting by these blades saves you vital man and machine hours on subsequent operations. Have you tested Capewell? You had better speak to your mill supply man today.

THE CAPEWELL MFG. CO.,
Hartford, Conn.,
U. S. A.

CAPEWELL

hanger fittings permit spanning of beams, and a minimum of slip-joint fittings cover all installation methods and requirements. No pipe threading equipment is required.

Installations for fluorescent lighting of working areas can be completed by using same basic channel with reflectors, glass inclosures, hangers and fittings for both unit type or continuous Line-O-Lamps fixtures.

Harnischfeger Develops Electrodes For Welding Armor Plate

Three electrodes have been developed specifically for welding armored vehicles that are offered by the Harnischfeger Corp., Milwaukee, Wis. Known as AW-1, AW-2 and AW-3, the electrodes are restricted to prime and sub-contractors who are doing armor welding under Army Ordnance Department regulations.

Leach Maxi-Cut Milling Head Holds Draw Collets up to 3-4 In.

A simple and rigid design are featured in the milling head offered by the H. Leach Machinery Co., 387 Charles St., Providence, R. I. This Maxi-Cut milling head clamps on a horizontal milling machine equipped with a 3½ in. bar. The spindle is equipped for draw collets with a capacity up to ¾ in. Either single or double end mills may be used. The total weight is approximately 75 lb. The head is convenient for milling, drilling, boring and facing operations.

DuGas Powder Compound Extinguishes Magnesium Fires

A powder compound for extinguishing magnesium fires has been announced by DuGas Engineering Corp., Marinette, Wis. DuMag powder is a compound of various chemicals and is moisture resistant, free flowing, nonabrasive and non-reacting with burning magnesium. It is applied directly to the fire.

NEW MATERIALS

Silver Brazing Alloy Is Leaktight, Needs No Grinding

A low temperature silver brazing alloy has been introduced by Handy & Harman, 82 Fulton St., New York, N. Y. No grinding is necessary after brazing and joints remain leaktight even when replating is necessary.

Bundyflex Copper Fused Steel Tubing Easily Bent

Bundyflex copper fused steel tubing has been made available by the Everhot Products Co., 2055-59 W. Carroll

Conco Torpedo Electric Hoist

Double Drum Construction — Push Button Control — Electric Solenoid Brake

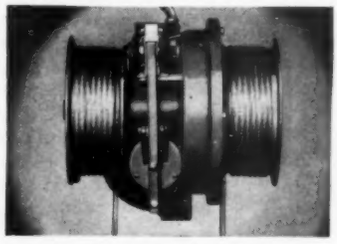
Hook, Bolt or Trolley Suspension — Anti-Friction Bearings — Enclosed Gearing

Only $139.50

FOR 250 - LB. CAPACITY

America is racing against time. Minutes count! And the Conco Torpedo Electric Hoist can save precious production minutes. Push Button Control, Limit Switch, Electric Brake, Enclosed Mechanism are all features which contribute to faster, safer, more effortless operation. The Conco Torpedo Electric Hoist is available in 250-Lb. capacity—$139.50; 500-Lb.—$149.50; 1000-Lb.—$159.50. And the simple, heavy construction of this hoist—employing only two gear reductions—means a long lived investment! Write for complete details.

SIMPLE HEAVY CONSTRUCTION



Illustrating Conco's double drum construction. Cast iron drums are 30 times diameter of plow steel cable. Load is better balanced; full lift is obtained without overlap of cable.

CONCO

ENGINEERING WORKS

BLUE DEPT. — MENDOTA, ILL.

For more than 20 years builders of hand-powered and electric cranes, hoists and trolleys.

Ave., Chicago, Ill. The tubing can be bent to practically any shape, hard or soft soldered, brazed or welded and serves many purposes where ordinary copper tubing is used. An outstanding feature of the tubing is its resistance to vibration in assemblies in which fittings are used. It is supplied in 25 or 50 ft. coils and 12 and 20 ft. straight lengths in tube sizes from ⅛ to ⅝ in. O.D. In sizes from ⅛ to ¾ in. Bundyflex is a double wall tube.

Curran Hand-Wiping Solvent Removes Corrosive Salts

Development of a hand-wiping safety solvent Gunk XP-92 has been announced by the Curran Corp., Malden, Mass. It will quickly lubricate and preserve wet metal surface from rust and removes corrosive primer salts from gun bores. The solvent also has other industrial uses as a naphtha substitute for grease cleaning and hand-wiping operations in plants engaged in war production work.

Presstite Compound Seals Tanks For Fuel Storage

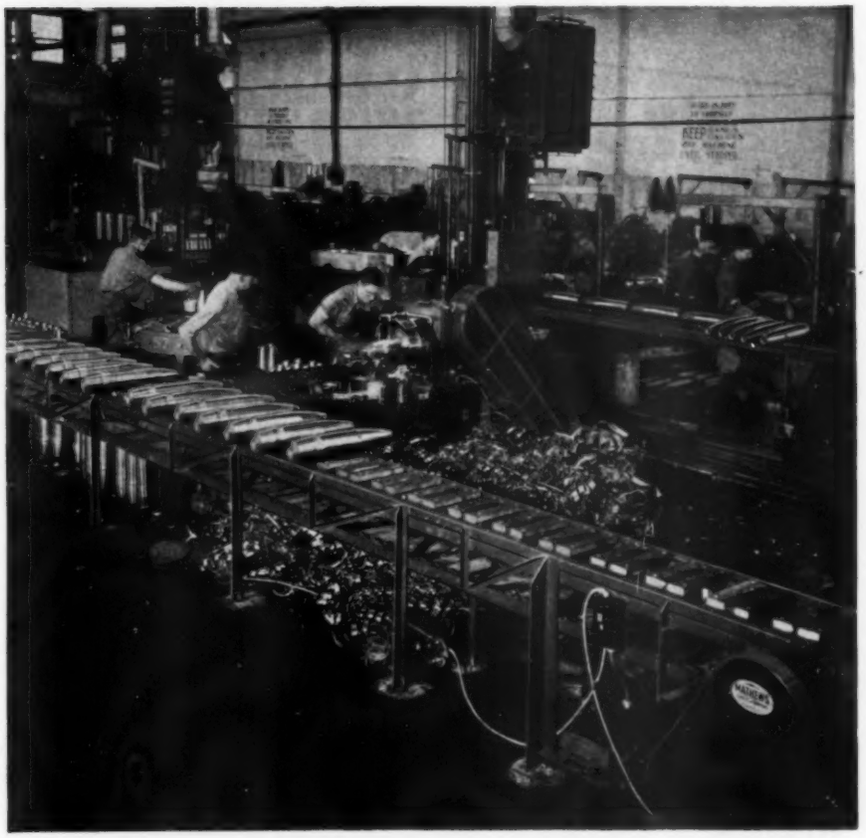
Designed to seal integral tanks in airplanes and for inside seams and joints in bolted steel tanks in airplanes and fuel storage purposes the Presstite Engineering Co., 3928 Chouteau Ave., St. Louis, Mo., has announced a brush-on type fuel tank sealer. The compound is applied with a brush or can be flowed on with a regular type of hand operated caulking gun. It will remain flexible at minus 90 F. and will not become soft or slump at temperatures up to 200 F.

Monsanto Solution Stops Iron Corrosion; Saves Tinplating

An organic chemical, known as D.P. Solution, when added in small amounts to clear lacquers, alcoholic shellacs and nitro-cellulose solutions such as pyroxylin and collodion, prevents corrosion of iron by these products, allowing them to be shipped in plain steel drums instead of the tin-lined containers formerly required. Developed by the Merrimac Div. of the Monsanto Chemical Co., the new solution is expected to save an estimated hundred thousand pounds of tin annually. Use of this chemical is more economical than the use of tin-lined containers.

Acme Flash-Off Eliminates Weld Spatter; Prevents Pitting

The Acme White Lead and Color Works, Dept, FS-19, Detroit, Mich., has introduced Acme quality industrial finish flash-off No. 99 to eliminate weld spatter. The mechanic simply brushes, sprays or wipes the product along the edges of the metal surfaces to be joined by the weld. Then when the welding



SHELL PLANTS DEPEND ON

MATHEWS

Conveyers

● Mathews engineering hours are reserved these days for manufacturers of war materials. Makers of munitions in the United States and Canada are watching production figures rise — assisted by Mathews Conveyer Systems. Perhaps you've overlooked an opportunity to "Keep 'em Rolling" faster by not taking advantage of the experience of your Mathews Engineer. If you have, a wire or a letter will bring complete information as to how Mathews can best serve you.

MATHEWS CONVEYER COMPANY

ELLWOOD CITY, PENNA.

Field Engineers and Sales Offices located in 30 Industrial Centers

DOUBLED CAPACITY FOR WAR PRODUCTION

Stepping up our productive capacity month after month has barely enabled us to keep pace with mounting war orders. As long as this condition exists, it becomes increasingly difficult to meet civilian requirements. Our one big job is the handling of war material. That job must come first.

V

Production means Victory

"YANKEE" VISE

Speeds Production

War means all-out production. All-out production demands the tools that can stand the punishment of ceaseless hours, endless work and still speed up the job. The "Yankee" Vise is just such a tool. Here's why:

1. **Sides, front end, and base are milled for interchangeable and accurate positioning on face plate or machine bed.**
2. **Detachable swivel base permits the vise itself to be transferred from bench to machine for drilling, tapping, or milling operations—and back to bench again.**
3. **Quickly, easily, and economically converted into milling, drilling, and tapping jigs.**
4. **Hardened steel block with V-shaped grooves, furnished as standard equipment, holds round stock securely.**

"Yankee" Vises are made in four jaw widths and two styles. No. 991–1½"; No. 992–2"; No. 993–2¾"; No. 994–4". These same sizes with the detachable swivel base feature are Nos. 1991, 1992, 1993, 1994.

Order from your supply house or write North Bros. Mfg. Co., Dept. A.M.6, Phila., Pa. Every effort is being made to reach a balance between supply and war-time demand.

"YANKEE" TOOLS

make good mechanics better

North Bros. Mfg. Co., Phila., Pa., U. S. A.

Established 1880

is done metal chips bounce or fall off instead of adhering to areas adjacent to the seam thus eliminating necessity of grinding or scratching these chips off.

The flash-off removes impurities from the weld, and being an excellent conductor of electricity helps prevent the weld arc from breaking. In addition it prevents pitting on galvanized or ungalvanized metal surfaces and permits immediate application of paint without cleaning operations other than wiping off. The product is available in 55-gal. drums and 5-gal cans.

Carbozite Protective Coat Resists Salt Water Action

For protection of bright steel and similarly highly finished products the Carbozite Corp., 906 First National Bank Bldg., Pittsburgh, Pa., has available a highly corrosion-resistant, quick-drying coating known as Carbozite shop coat. The standard coating, which is the quick-drying type, deposits a protective skin about .002 in. thick and is claimed to resist severe salt water exposure. Heavier coatings with slower drying times, but having service life for many years can be readily furnished.

Keystone Polishing Pad Removes Abrasion Traces

For finishing the surface of cylinder walls more efficiently the Keystone Carbon Co., St. Marys, Pa., has produced a polishing pad. Use of this product after grinding removes all traces of abrasion, sharp edges and creates an inert finish on the cylinder wall which eliminates premature piston and ring wear. Pads are furnished to fit standard sizes of grinders and hones and can be made into any size or shape.

Post Tracing Cloth Has Velvety Finish; Takes Pencil

A tracing cloth which has a velvety surface and takes a dense and sharp pencil mark has been introduced by Frederick Post Co., Hamlin & Avondale Aves., Chicago, Ill. This No. 125 Penciltex is tough, durable and will not discolor with age. An added feature is its glossy, stay-clean back and extra transparency. It is furnished in 20 yd. rolls in widths of 30, 36 or 42 in. or in sheet sizes to suit requirements.

Cowles Detergent Develops Emulsion-Type Metal Cleaner

Lixol, an emulsion-type metal cleaner, announced by The Cowles Detergent Co., 7016 Euclid Ave., Cleveland, Ohio, is suitable for use on all metals. It can be used alone or diluted with water or kerosene and leaves an invisible oil film.

TRADE PUBLICATIONS

AIRCRAFT TOOLS A complete catalog has been issued by Aircraft Tools, Inc., Los Angeles, Calif., describing small tools for aircraft construction and maintenance.

CIRCUIT BREAKERS Small oil circuit breakers are described and illustrated in a 12-page catalog issued by the Roller-Smith Co., Bethlehem, Pa.

CONSERVATION Manning, Maxwell & Moore, Inc., Bridgeport, Conn., are distributing folders each month telling how to make their products last longer.

DUST COLLECTORS Knock-down and assembled types of "Dustube" dust collectors are described in a 58-page catalog, No. 72, published by American Foundry Equipment Co., 555 Byrkit St., Misawaka, Ind.

FLUXING The new Krembs Chart which gives quick answers to fluxing questions may be obtained from Krembs & Co., 669 West Ohio St., Chicago, Ill.

GENERATOR A bulletin describing Type 215 low-frequency linear-time-base generator and its applications is available from Allen B. Du Mont Labs., Inc., 2 Main Ave., Passaic, N. J.

HEAT TREATING Lithco and Lithcarb principles and data are given in an eight-page booklet published by The Lithium Corp., Raymond-Commerce Bldg., Newark, N. J.

HOISTS Bulletin No. 142, published by Chisholm-Moore Hoist Corp., Tonawanda, N. Y., contains 22 pages of photographs and descriptions of CM Meteor heavy duty electric hoists.

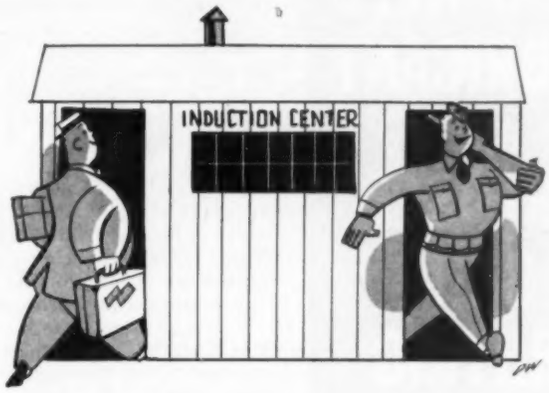
LATHES Schauer Machine Co., 2060 Reading Rd., Cincinnati, Ohio, has designed a 24-page catalog describing the Ideal line of speed lathes.

LIFT TRUCKS A brochure describing the design features of 6,000-lb. capacity lift trucks and outlining variations in the equipment to meet individual requirements is offered by Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill.

LIGHTING The No. 40 catalog of the Edwin F. Guth Co., 2615 Washington, St. Louis, Mo., presents a complete line of up-to-the-minute luminaires intended for use in fluorescent and incandescent lamps.

BEARINGS An 8-page installation data sheet describing "Compo" oil-retaining porous bronze bearings is offered by Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

(Continued on next page)



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Let any man who hesitates to convert his plant from peace production to war production take a look at Mr. Buck Private. His case is *real* conversion.

He's been converted from a shipping clerk, a gas station man, a farm hand, or a bond salesman into a hard-muscled, hard-hitting, tough-fighting "son of a gun."

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Conversion is not easy . . . not easy for anyone. But today we are in a war . . . the most difficult war we have ever fought. The question is not "What is comfortable and easy?" It is "What must we do to survive?"

The hard fact is that if we are going to survive we must outproduce the enemy—and to outproduce the enemy we must convert peacetime plants to wartime plants.

Geo. D. Trundle Jr.

P.S. Every man jack in my organization is on some war job today.

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MAGAZINE "Ceco Sparks" is a publication of the Chambersburg Engineering Co., Chambersburg, Pa.

MARKING DEVICES An 8-page descriptive booklet entitled "Marking Devices" is available from New Method Steel Stamps, Inc., 145 Jos. Campau, Detroit, Mich.

METERS The Esterline-Angus Co., Inc., Indianapolis, Ind., has issued a series of booklets called "Solving Industrial Crimes" which give case histories on the use of Graphic Meters to supervise machines and processes.

PACKAGING An illustrated booklet entitled "Unit Packaging" is available from the Clark Tructractor, Battle Creek, Mich.

PRESSES Powder metallurgy and automatic equipment for producing parts by tabletting or compressing methods are described in catalog No. 41-T, a 48-page, illustrated book, published by F. J. Stokes Machine Co., Philadelphia, Pa.

PUMPS "Facts You Should Know About Rex Speed Prime Pumps" is the title of bulletin No. 400 prepared by Chain Belt Company of Milwaukee, Milwaukee, Wis.

PUMPS Entitled "Horizontal Pumps," Bulletin 120-A is an eight-page illustrated bulletin describing high pressure, motor driven, horizontal pumps and two-plunger steam pumps, released by The Watson-Stillman Co., Roselle, N. J.

RECORDERS Control instruments and recorders are illustrated and described in Catalog No. 1101G issued by the C. J. Tagliabue Manufacturing Co., Park and Nostrand Aves., Brooklyn, N. Y.

SHAPERS Bulletin GS-42, a 12-page booklet covering the shaping of involute gears of all types, is offered by the Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.

SHEET METALS A data chart has been prepared by Apollo Metal Works, 66th Place and S. Oak Park Ave., Chicago, Ill., giving information on a series of metal substitutes for critical materials in a wide variety of applications.

SLOTTING HEAD The Universal Slotmaster, an attachment for milling machines, is described in a four-page folder issued by Experimental Tool & Die Co., 12605 Greiner Ave., Detroit, Mich.

SPRINGS "Manual of Spring Engineering," a 132-page publication covering all types of springs, may be obtained from the Sales Promotion Department, American Steel & Wire Co., Rockefeller Building, Cleveland, Ohio, be request made on a company letterhead.

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COOLANT SUPPLY
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TEMPERATURE CONTROL Catalog A14, a 12-page folder issued by Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia, Pa., describes their full line of electric motor valve operators as applied to standard temperature control systems for fuel-fired furnaces.

TEMPERATURE CONTROLLERS The Foxboro Co., Foxboro, Mass., has prepared an illustrated bulletin describing temperature controllers.

WELDER Bulletin No. 501, a four-page folder describing design and operating features of the standard pedestal welder, is available from Progressive Welder Co., 3050 East Outer Drive, Detroit, Mich.

WELDING The Frostrode process of refrigerated welding is described in a four-page folder published by Frostrode Division, Weltronic Corp., 3080 East Outer Drive, Detroit, Mich.

NEW BOOKS

OPTIMUM HOURS OF WORK IN WAR PRODUCTION—*By J. Douglas Brown and Helen Baker. 25 pages. Published by Department of Economics and Social Institutions, Princeton University, Princeton, N. J. $0.75.*

The acute need for the greatest possible production of war materials gives national significance to the question: What is the maximum number of hours per day or week an individual can work and maintain his highest efficiency? This report, representing a survey of 140 companies which employ approximately 2,000,000 men, gives conclusions intended as answers to this question.

Experience with employee fatigue in schedules ranging from 40 to 60 and more hours per week are listed. Important factors in the determination of optimum hours are discussed. These include the physical effort required on various jobs, the effect of work intensity, and the physical capacity of workers.

•

PRODUCTION ENGINEERING—*By Earl Buckingham. 268 pages. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. $2.50.*

The problem of production engineering has three major phases: (1) To prepare for and to start the production of a new product or to make a major change in the design of an existing product; (2) control the orderly and effective operation of the plant in the continued production of the product; (3) to initiate activities that gather information and put it into effective form for its application to the two preceding phases. Since these phases involve an almost infinite num-

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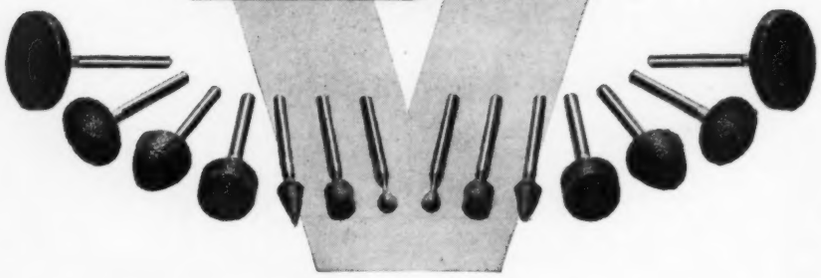
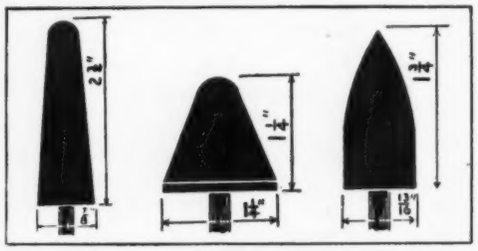


Speed and Smoothness in cutting action—Longer Life—that's what you get when you use Chicago Mounted Wheels.

Made in all types of abrasives, grains and grades, mounted on shanks of different diameters and lengths — there is a Chicago Mounted Wheel to lick every grinding job from the most intricate cartridge dies to snagging hard-to-reach parts on tanks. For high-speed POLISHING, the sensational new Chicago Soft Rubber Mounted Wheels save hours of tedious hand work.



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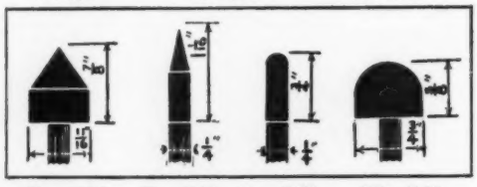

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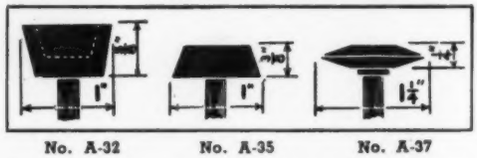

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HI-POWER GRINDER

The 3-pound grinder with perfect balance—a real he-man production tool that is saving hundreds of hours in our national war effort. Ample power to drive a 2½" diam. wheel. 17,000 r.p.m. Encased with 3 Chicago Mounted Wheels, Drum Sander and Bands, extra Collets, Wrenches, Dressing Stone, $38.50.

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ber of petty details which must be taken care of by the cooperative effort of many persons, the author emphasizes throughout the text the importance of coordinating the effort of many individuals, each of which has a specific task to accomplish.

This involves not only the obligation of carrying through work in conformity with that completed in earlier stages, but also the responsibility of reporting facts pertaining to joint efforts, together with suggestions for present or future improvement. One of the primary purposes of the text is to point out the fundamental lines of responsibility and authority involved in this phase of production engineering activities.

The author discusses in detail the foregoing factors and their relation to each other. No attempt has been made to treat in detail any part of this work of production engineering, except where existing texts appear to be inadequate or non-existent.

•

MACHINE TOOLS AT WORK—*By Charles O. Herb. 544 pages. Published by the Industrial Press, 148 Lafayette Street, New York, N. Y. $4.*

Many people have become interested in the design, operation and application of machine tools. This text, profusely illustrated with views of machine tools, discusses the function of a large variety of modern machine tools, such as are used for turning, drilling, milling, planing, grinding and broaching.

The author discusses and illustrates actual machining operations, including tooling, work-holding devices, and other auxiliary equipment. These are accompanied by facts about each job, with specific data on speeds, feeds and production rates given in many cases. Applications of many highly developed special machine tools are listed.

•

GENERAL TRADE MATHEMATICS—*By E. P. Van Leuven. 575 pages. Published by Whittlesey House, McGraw-Hill Book Co., 330 West 42nd St., New York, N. Y. $3.50.*

A man learning or re-learning a trade needs a thorough grounding in mathematics. This book, which is suitable as an elementary mathematics text as well as a mathematics reference book, was written to meet the needs of students who intend to specialize in some branch of shop work. It is designed to permit each student to proceed at his own level of achievement.

Beginning with a presentation of whole numbers, common fractions, decimal fractions, rules and formulas, powers and roots, and percentage, the author proceeds in easy steps to the application of ratio and proportion, graphs, surface measurement, and the

construction of geometric figures. Final chapters of the text are devoted to the application of these principles in lumber measurement, calculations of plastering and protective coatings, rules and formulas for pulley speeds and diameters, and surface speeds of rotating elements. Specific applications of mathematical formulas will be of interest to those interested in machine tools, electricity, and the building trades.

The book covers 150 practical topics, supplemented with over 3,000 exercises and problems selected from shop situations. These give sufficient practice for the average student to become familiar with each usage; furthermore, they serve as a background for his trade training.

•

EMPLOYEE TRAINING — *By Alfred M. Cooper. 311 pages. Published by the McGraw-Hill Book Co., 330 West 42nd Street, New York, N. Y. $2.50.*

Sprinkled throughout industry there is a relatively small group of men and women whose job it is to train employed workers. This group will be interested in the text, because it develops a practical formula for getting people to carry out satisfactorily and willingly work which has been assigned to them.

Emphasis is placed on the rehearsed-conference method of employee training, because of the great saving in training costs and the superior carry-over to the job inherent in this method. However, should the training supervisor for any reason prefer to carry on all educational activity in his organization through staff instructors, the subject matter outlined will be found applicable, whether or not the rehearsed-conference method is employed.

Upgrading of employees through supervisory and executive training, public relations training, advanced sales trainure the effectiveness of this effort in terms of improved employee performance.

•

MANUFACTURING PROCESSES—*By Myron L. Begeman. 580 pages. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. $4.50.*

Crowded curricula in engineering colleges and industrial training courses have made it necessary to limit the amount of time devoted to the technical fundamentals of important manufacturing processes, engineering materials, and modern equipment necessary for processing these materials. This book should be valuable in such cases.

Approximately 50 percent of the text is devoted to the subjects of foundry practice, pattern work, metal casting, plastic molding, heat treatment, and welding. The latter half of the book is given over to production machines, accessories, cutting tools and measuring

KEEP WAR PRODUCTION ROLLING!
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Planned and installed to meet handling needs in your plant, Standard power driven or gravity operated conveyors assure smooth, uninterrupted service 24 hours daily, a full seven days per week—keep materials and parts flowing—fast and sure—from machine to machine—department to department—help maintain the swift tempo of wartime production.
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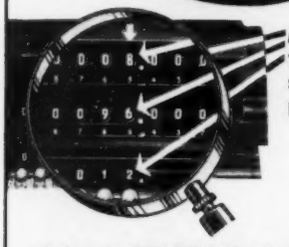

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☐ *Send pamphlet* "Adding Fractions for Checking Drawings." AM/6/11/42

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instruments. In all cases the information is fundamental in character, and consists of describing the machine or process as well as discussing its range of application and limitation. At the end of the book are listed a number of typical projects, which are designed to give the student actual experience with all the principal types of production equipment.

SEEN and HEARD

By JOHN R. GODFREY

Converting Inspectors

The superintendent of a large automobile body plant became alarmed by the high percentage of rejects on aluminum aircraft stampings to which his facilities had been converted. He understood well enough the necessity for greater precision than on automotive work. He knew that highly stressed parts could carry no scratches, sharp corners or other variations from the blueprint. But he did not see why parts used as covers, instrument panels and similar non load-bearing members needed to reach such heights of perfection.

He looked thoughtfully at the master stampings furnished by the airplane builder and approved by the military inspectors as models of workmanship. Were these parts, after all, so much better than those bouncing back daily from the wall of inspectors that scrutinized his products? He made up his mind to find out.

Next day these master samples were mixed with his production run and reached inspection as part of the day's output. Sure enough, they too were rejected.

That gave the superintendent the toehold he needed. He argued that precision was fine, but if carried too far it meant no production. Besides, his work was just as good as that of the airplane manufacturer who used these parts. Finally he reached a compromise whereby the inspectors agreed to be less ruthless in tossing out unstressed lids and cover plates having only semi-visible wrinkles. He agreed to more accuracy on key components. And production rose like a bomber taking off.

Dents and Scratches

Surface finish has gone through many changes. First was that of drawfiling and polishing with emery cloth. Then came grinding by traversing the work under the periphery of a wheel, which taught us to think that the surface was smooth because the "scratches" were straight lines.

From this viewpoint the surface left by the cup wheel in the vertical spindle grinder was highly undesirable. Both Pratt & Whitney and Blanchard had to overcome a lot of prejudice before we could realize that the surface they produced was at least as smooth as the other.

Now we have another phase of surface condition because we have found that even minute scratches, only a few millionths of an inch deep, may allow a crack to start in highly stressed parts. So, instead of trying to get a dead smooth surface we grind one that is very good and then "shot blast" it instead of polishing it. This makes a matt finish in which a multitude of minute indentations take the place of the shallow scratches caused by grinding.

The small "pin-point" indentations seem to break up the tendency for cracks to start. With the small indentation there is no line of direction provided. This method seems to be working out satisfactorily on such highly stressed parts as aviation engine connecting rods.

Rolling and Grinding

Thread rolling was invented many years ago. Its early application was to rough work such as railroad track bolts. As methods improved and men began to make better dies, the quality of the work stepped up appreciably until some tried rolling screws for micrometers. Now one well known tap maker is rolling high speed taps and also cylinder studs for airplane engines. The rolling method has taken the place of grinding the threads from the solid in some instances.

Centerless grinding went through similar growing pains. Among the early experimenters was Rob Grant in his little shop in Detroit. His first practical application of the method was to spring straddle bolts for automobiles; they were not always round. Now centerless grinding machines turn out work that is a marvel of accuracy and finish.

TO THE EDITOR

A Basket of Pins

Dear Sir:

The comments received from various readers on my article "Measuring Gear Tooth Thickness" (AM—Vol. 86, page 278) are greatly appreciated.

In today's triple-speed industrial effort many of us find ourselves making parts which in ordinary times we would not consider. Tools and gages accumulated for our usual production items are in many instances not applicable to these special products, and with toolrooms and suppliers swamped, we devise various methods to get a job out by utilizing that which is available.

In addition to these unusual items, various experimental jobs turn up, so that our bag of tricks must be opened to avoid special tools which will never be used again.

One reader, however, Mr. R. S.

Wright, is unusually fortunate (AM—Vol.86, page 486). Apparently he has at his disposal a complete series of micrometers from 0 to 100 in. or even larger. With these tools and a basket of pins he can do what all of us prefer, measure over rolls. We who are less equipped find that a little extra mathematics can get out a good job and have it shipped by the time the paper work to order new tools would be completed.

CLYDE A. YOUNG

Electro-Motive Division,
General Motors Corporation

Small Shops

Dear Sir:

I received your invitation to comment on your editorials, and in reply I will select an editorial of two or three months ago which did not please me at all, in fact it left a bad taste in my mouth, for the reason that you were not fair to the small business man with regard to government work.

You stated (I quote from memory) that the small business man does not know how to work to a small tolerance, that he is not capable of handling government work, and you wound up by saying in so many words, to give him charity but not work, as he will do more harm than good.

You also mentioned some large firm that gave out work and then had to do it over.

If your statements were true I would not blame you so much, but I happen to know, from personal experience, that the owner of a small machine shop who employs three or four men is capable of supervising twenty or more men if given assistance. I can mention one firm which rented about 500 sq. ft. from me a few years ago and were doing a small jobbing business, employing two tool makers, and they are today in a large factory, employing over a hundred men with the same skilled tool makers.

Very truly yours,

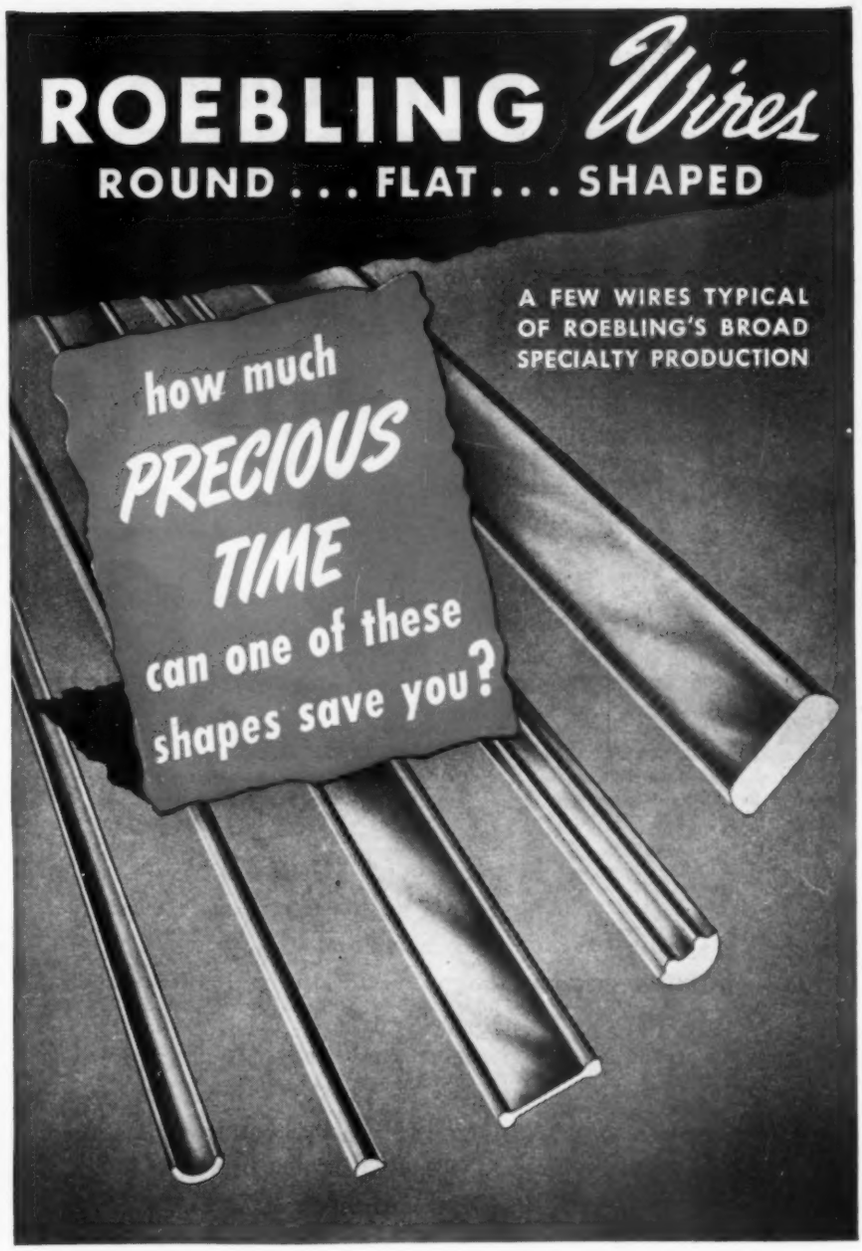
M. PODELL, *President,*
Star Fuse Co., Inc.

Welding Solves a Pipe Problem

By ARTHUR HAVENS

We sometimes wonder how a mechanic could accomplish a decent day's work before welding was adopted. An emergency which gives added weight to such thought occurred recently when high-pressure steam pipes, installed with the usual screw fittings, began to leak in a tunnel running under the tracks of a large railroad yard. The steam pipes ran from a central power plant and fed a group of shops scattered on both sides of the yard.

The tunnel is 5 ft. square, 400 ft. long, and is 10 ft. underground. During construction, the ends were left open so that steam and air lines could be in-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A FEW WIRES TYPICAL OF ROEBLING'S BROAD SPECIALTY PRODUCTION
how much PRECIOUS TIME can one of these shapes save you?

The right special shaped wires can save you hours of time—*time that's vital.* Making them is a specialty. Some users demand toughness and resiliency . . . others uniform temper held within close limits . . . still others, ability to withstand severe strains. But they *all* require steel of uniform analysis, dimensions and finish.

Are your round, flat or shaped wire requirements in this "tough" class? If so, put the job up to Roebling! We have the skill, experience, and facilities to help you "beat the quota."

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Headstock moved back and at angle position for grinding tapered hole.

Looking down on top of machine from grinding spindle end.

Offers greater flexibility . . . a precision grinder, designed and built by engineers with years of practical experience to guide them . . . has a headstock traverse of 6" . . . grinds holes ¼" to 18" in diameter . . . holes up to 9" deep, straight or tapered . . . entire headstock may be moved at right angle to wheel traverse, by merely loosening two conveniently located nuts . . . worm compensating device permits grinding wheel head adjustment to .0001 . . . sturdy construction throughout . . . full specifications, delivery time and price on request.

134 Distributors in U. S. and Canada to serve you.

Saw-way TOOL AND MACHINING CO.
13842 JOS. CAMPAU AVE. DETROIT, MICHIGAN

stalled; afterward, the tunnel was sealed, but a small manhole was left at each end. The designer must have believed that nothing would ever happen to the steampipe.

For ten years or so all went well, and then the flanges started leaking. This caused no serious trouble, even though the steamfitters had to work in 2 or 3 in. of muck, and a temperature of 200 F. The next ailment brought complications, because the flanges began leaking in the threads. The steamfitters threw up their hands in despair, because it was impossible to take anything but a short piece of pipe into the tunnel. Dozens of suggestions were advanced and found wanting. Then their thoughts turned to welding.

The leaky flanges were removed with a cutting torch, taking enough each side of the flange to insure a good bond for the weld. With a helper holding an air hose blowing a full 100 lb. pressure directly on his face, the welder substituted 14-in. lengths of pipe where each leaky flange was removed. Expansion joints, by-pass and other threaded arrangements were treated in like manner, all with welded pipe. Of course, difficulties were encountered—the pipes were so close to the tunnel wall at some places that welding on the backside of the pipe was impossible. Here the welder tacked the pipe in place, removed a front section large enough to permit him to work his torch in the pipe, and then weld the backside from the front. The front piece that had been removed was then held in place, and welded.

This usually steam-filled tunnel is now free from escaping steam and no longer do steamfitters have any worry about how they are going to repair leaks in the tunnel. This is just another example of how a shop welder may be called upon to solve an almost impossible problem encountered by shop maintenance crews.

Repair Maintains Power

When a troublesome noise in a 28×32 poppet valve crank necessitated tearing down a steam engine in an eastern metal working plant, the chief power engineer found that the upper stud was broken off of the wedge, about ⅜-in. from the shoulder. Immediately he had the engine builder on the phone. "No wedges in stock and three days to make one," said the builder. That meant 40 percent of shop production would be held up while the engine was down, so it was decided to try to repair the wedge. After heating it to between 500 and 700 F., a stub of chrome manganese steel was welded onto the broken wedge. P&H "Harnimoly" was used, an electrode designed for joining high carbon or alloy steels subject to machining and heat treatment.

After cooling, the stub was turned and threaded, and installed in the en-

gine. At 9:50 p.m., exactly six hours after shutting it down, the engine was running smoothly again. What might have been a big headache was cured at a total shop cost of $3.25, including labor and material. A new wedge would have cost over $60 and the engine would have been shut down for not less than three days waiting for it.

Is Nobility a Handicap?

Nobility, if the term means too good for common use, may be a handicap. When the term is applied to a metal, even though it is intended to denote ability to resist corrosion, it may result in setting such a metal as silver apart, as too good for wide use in industry. This has been a handicap to the use of silver in industry because the engineer or production man unthinkingly regards silver as a luxury rather than as a metal with industrial uses. But industrial uses for silver have been growing steadily and today, with silver as one of the few metals not restricted to war uses, they are destined to multiply.

Silver costs more than most base metals, but it also does things which the base metals cannot do and can take their place in some applications for which they are now not available. Silver can be and is being made to go a long way, but even where conditions call for using it in large quantities, it may not be prohibitive, since it always has a high reclaim value.

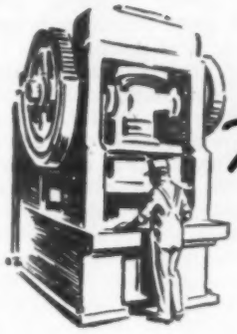
Helping Ourselves

Action can be taken to increase the output of machine tools by relieving the makers of much unnecessary work. Money and time have been wasted through the ordering of an undue proportion of elaborate types of machines in relation to those of simpler design. Evidence of this unfortunate fact stands out in practically every toolroom and in every workshop.

It is true that the toolroom requires a certain proportion of universal mills, universal grinders and complete toolmakers' lathes, but from 75 to 90 percent of even toolroom work for war production can be done by plain mills, plain grinders and good commercial lathes. All surfaces, whether cylindrical or plane, in which a high degree of accuracy is necessary, are finished by grinding. The preliminary processes, therefore, do not call for extreme accuracy or for high finish.

Tradition dies hard, and the screw-cutting lathe has become a fetish. Nowadays the self-opening die head and the thread milling machine deal with 90 percent of the screws in the average shop, but still users persist in ordering (and makers continue to supply) hundreds of screw-cutting lathes, although most of them never have cut

★



MORE *Productive* HOURS

Men cannot work too long hours at a stretch without marked loss of efficiency. . . . But machines can work in triple shifts, if necessary.

Ross valves have met—and are now meeting—in war work . . . the needs of maximum machine production hours.

Bring your air control problems to

ROSS *Operating* VALVE CO.

6489 Epworth Boulevard

DETROIT, MICH.

ROSS *Air Control* VALVES

THE BRIDLE FOR [illegible] AIR HORSEPOWER

★ ★ ★ ★ *A SIZE AND TYPE FOR EVERY OPERATION* ★ ★ ★ ★

HAND CONTROL | FOOT CONTROL | SOLENOID CONTROL | MECHANICAL CONTROL | PILOT CONTROL | ALL AIR CONTROL

a screw and never will. A simple straightforward sliding and surfacing lathe is all that is required in the large majority of shops.

Taper attachments for lathes are essential, of course, when tapers have to be produced, but the percentage of taper work is usually extremely low, and yet unused taper attachments are lying idle on scores of machines.

The great bulk of cylindrical grinding can be accomplished more rapidly and satisfactorily on plain machines, and yet universals are frequently ordered on the chance that some day or other they may be required. Many milling machines are equipped with elaborate dividing heads, circular tables and other devices, the bulk of which spend their time on the shelves or under the benches. Turret lathe makers are still fitting an altogether unnecessary proportion of their machines with chasing saddles.

Not only do these elaborate machines involve waste of labor in building, but they are far less easy to operate than the plain machine, particularly where semi-skilled labor is employed. We have allowed ourselves for far too long to be slaves of tradition; it is high time that we should awake to the real needs of today and amend our ways.

Abstracted from a letter by Alfred Herbert in The Engineer, *London.*

Silver as a Tin Substitute

Even before the tin shortage, silver had replaced tin on a small scale in a few applications, as in aircraft engine bearings. Today silver, of which there is no shortage, can help still further to replace tin.

There are, for example, several good solders containing from 2 to 6 percent of silver and the balance chiefly lead. Even in normal times such solders cost little if any more than those having 25 to 50 percent tin. They melt at somewhat higher temperatures, but for some purposes this is an advantage, as it permits using these solders where those high in tin would soften or fail in service.

Silver is a possibility for collapsible tubes. It is a fine, ductile metal, presumably adapted for impact extrusion employed for making tin, aluminum and some zinc products. Silver costs more than these metals but, by the same token, it has greater value when the contents are used up. Vendors might offer to buy back the tubes or apply their cost to the purchase of more paste or cream. Silver is high in corrosion resistance for many purposes and has certain sanitary properties not possessed by other metals.

Silver foil is another possibility worth exploring, as are silver plated cans, at least for some purposes. Much information along some of these lines has been accumulated by the American Silver Producers' Research Project and is available to manufacturers.

NO MAGIC —ABOUT THE LONG LIFE THAT MOTOR USERS GET WITH WESTINGHOUSE CS MOTORS— SIMPLY SEALED SLEEVE BEARINGS.

..JUST ANOTHER REASON WHY WESTINGHOUSE MOTORS ARE YEARS AHEAD!

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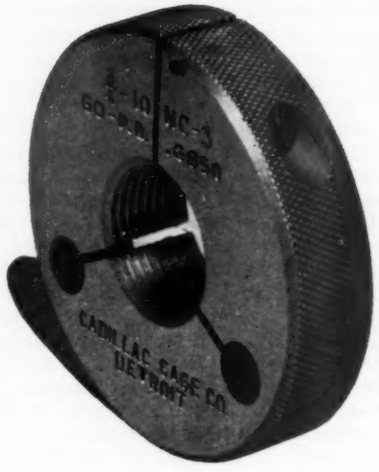
WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY E. PITTSBURGH, PENNSYLVANIA

FOR *accuracy* CADILLAC THREAD RING GAGES



As specialists, we manufacture thread plug and ring gages for checking National, Whitworth and special form threads from your smallest size requirements to six inches in diameter. Special thread checking fixtures and thread alignment gages are built to customer's design. Orders and re-orders from the largest armament manufacturers testify to the accuracy of CADILLAC Gages. *Let us serve you!!*

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20316 Hoover Rd. Detroit, Mich.
★ MANUFACTURERS of
THREAD PLUG AND RING GAGES
AND OTHER THREAD CHECKING EQUIPMENT

Cadillac OF DETROIT

BOUT of the O'TOOLS

10 ROUNDS—AIR VS. HIGH-CYCLE GRINDERS

AIR TAKES ROUND 6 TO THE TUNE OF 70 ROTOR GRINDERS

This manufacturer of marine engine parts had some HIGH-CYCLE tools in other departments and leaned toward that type for new requirements—mostly light work for die grinders. Air supply was adequate. They called in the *Rotor Analyst* for his unbiased recommendation.

RESULT:

The *Rotor Analyst* studied the applications thoroughly, tried out both types of tools and recommended AIR in order to give them:

Higher Speed . . . 21,000 r.p.m. for AIR vs. 10,800 r.p.m. for HIGH-CYCLE. Needed this higher speed for peak output with small die grinders.

Lighter Weight . . . exceptionally light Rotor AIR Grinders had the edge on HIGH-CYCLE due to easier maneuverability and handling.

Quicker Installation . . . AIR compressor lines were already in. M.G. set and wiring for HIGH-CYCLE would have to be installed, involving delay and expense.

Result: They purchased 70 Rotor AIR Grinders.

AIR OR HIGH-CYCLE FOR GREATER OUTPUT? ASK THE ROTOR ANALYST!

Let him study your problems and give you an unbiased opinion on which type is best in your particular case. The *Rotor Analyst* has the experience and he has 65 different AIR tools and 59 different HIGH-CYCLE tools with which to lick your portable tool problems. Call him in. No obligation.

An ANNOUNCEMENT

OF MAJOR IMPORTANCE TO ALL USERS OF GAGE BLOCKS

★

Effective May 31 the entire enlarged production facilities of WEBBER GAGE CO. will be concentrated *exclusively* on the manufacture of *GRADE A* Gage Blocks.

For the duration, WEBBER GRADE B and other sets will no longer be produced.

WEBBER Grade A blocks are the most accurate now available for commercial use. Every block is guaranteed accurate to within .000004".

One of the major reasons for this action is that WEBBER Grade A Blocks are produced so *consistently* within "A" limits of accuracy (.000004") that few "seconds", which normally go to make up Grade B & C sets are available.

We believe that concentration on the manufacture of Grade A Blocks at this time will permit increased production with speedier delivery to users engaged in essential war work.

All orders for GRADE B and other sets on our books as of May 31 which have been duly acknowledged and scheduled for delivery will be properly filled. On and after this date no orders will be accepted for any but GRADE A Blocks.

Prices for WEBBER Grade A Blocks—Set #81A, $350.00, Set #40A, $185.00—compare favorably with lowest priced gage blocks now on the market.

Favorable delivery on Sets #81A and #40A to firms furnishing necessary priority certificate.

Webber
GAGE COMPANY
12901 TRISKETT RD., CLEVELAND, OHIO

IMAGINEERING: GETTING OUT OF THE GROOVE

THESE FOUR YOUNG WOMEN, so earnestly mastering the art of torch-welding aluminum, suggest that someone, somewhere, has checked out of the groove and started some practical Imagineering.

THEY PROVE what we've been saying for years: Alcoa Aluminum is easy to fabricate. The man who started the school where these girls are learning, and graduating to war jobs, simply had imagination enough to believe that

easy really means *easy*. Then he did something about it!

IMAGINEERING is letting your imagination soar and then engineering it down to earth. It is ingenuity in modern dress.

IT IS THE THING that has enabled the aluminum industry to keep on top of a plane schedule, increased tremendously in numbers, but also calling for almost twice as much aluminum per plane as the average plane needed two years ago.

IT IS WHAT EVERY ONE OF YOU are doing on your war job. Simplification, standardization, training. New methods, new materials, new records.

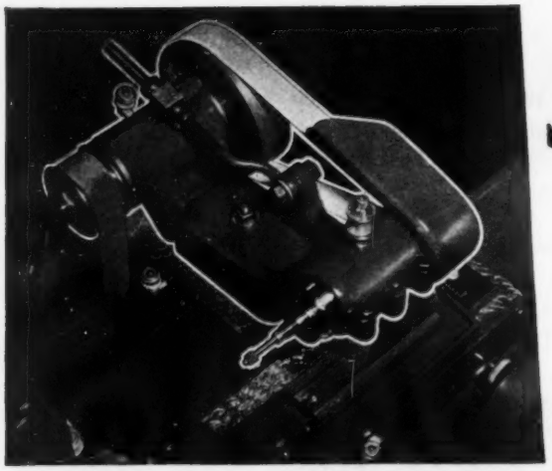
THIS WAR is showing Americans what they really can do if they try.

LET'S MAKE a vow to carry this same spirit over into postwar America. We'll all have the skills, the habit of work, the thrill of doing. There will be lots of aluminum to make into better products than peacetime America ever knew. It will be a great day for Imagineers.

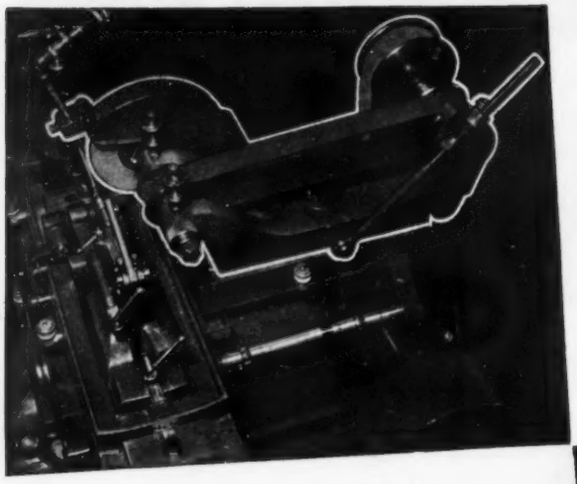
Aluminum Company of America, 2107 Gulf Building, Pittsburgh, Pennsylvania.

★ SO MUCH SO SOON ★

ALCOA ALUMINUM



Internal-External Grinding



INTERNAL GRINDING

Internal spindle is driven by belt from main drive motor, as shown at left above, at speeds up to 35,000 r.p.m. Holes from the smallest up to 3" diameter can be ground with maximum 4" power or 11" hand table reciprocation.

EXTERNAL GRINDING

External grinding attachment readily interchanges with internal spindle bracket on the cross slide, as shown at left, and is used for grinding straight and taper diameters or bevels. A wheel up to 6" maximum diameter by 1/2" face can be used.

RIVETT No. 104 GRINDER

is designed to meet the demand for a small grinder suitable for precision tool making and accurate manufacturing. It may be used as a single-purpose production machine or for the many internal and external grinding requirements of the tool room. Its ease of set-up and wide range of adjustment make it more economical on small lots of parts than a heavier machine.

Although primarily an internal grinder, an external grinding attachment is offered to interchange with the internal spindle bracket. The Rivett fixed diamond is used both for truing either internal or external wheels and for maintaining sizes on duplicate work. For further information write for bulletin 104-C.

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

2,181 shell forgings

in an eight-hour shift

only **1** reject

a **record** output

on Southwark

hydraulic equipment

2,181 shell forgings in an eight-hour shift . . . only 1 reject — a record output on Southwark hydraulic equipment

In an eight-hour shift, National Supply Company produced 2,181 medium size shell forgings on Southwark Hydraulic Forging Presses with only one forging rejected. This is a record run on a single manufacturing line for this company.

For sustained high production of forgings, 75-mm to 16-in. diameter, no shell forging process excels the hydraulic press method. The record made by National Supply Company is typical of many Southwark installations in plants from coast to coast.

Regardless of your production requirements—billet-breaking, piercing, drawing and nosing—there is a Southwark press to help you produce a greater number of forgings with a lower percentage of rejects.

Southwark also builds high pressure pumps, all types of valves and accumulators; engineers plant piping and forging plant layouts. Whether you need a complete shell forging plant or a single quick-acting operating valve, it will pay you to secure Southwark's recommendations first. Baldwin Southwark Division of The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, Calif.

BALDWIN

Southwark

BLW THE BALDWIN GROUP

DIVISION OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

PITTSBURGH POST-GAZETTE—MAY 7, 1942

2,181 Perfect Shells, only One Bad—A Record

Producing a record run of 2,181 shell forgings on a single manufacturing line in an eight-hour shift, this crew employed by the National Supply Company had only one forging rejected by ordnance inspectors. Foreman James O'Neill holds the one scrap shell out of the record run. Members of the crew left to right are: Front row, John Tomplack, Piercing Press Operator; James O'Neill, Plant Foreman; Frank Wargo, Leader; Arnold Goss, Cooling Bed Tender and Edwin Miles, Drawing Press Operator; Standing—Joe Rattlesdorfer, Ordnance Inspector for the Army; Howard Lutz, Cooling Bed Tender, Virgil Blosser; Furnace Discharger; John Beeler, Relief Man; Alex McClellan, Piercing Press Operator; Walter Srewnowski, Relief Man, George Ruddy, Checker; Sheridan Wilson, Tongue Man and Zeno Lazzaretti, Furnace Charger.

FLASH . . . A few days later, another crew at National Supply Co. established a new record—they produced 2,277 shell forgings in an eight-hour shift, WITHOUT A SINGLE REJECT.

In building our war machine, there must be no sacrifice of quality for speed. America must have not only the most, but also the best that its industries can produce. The physical properties of materials must be known by both producer and fabricator alike—specifications must be met, there can be no compromise.

It's easy to run fast, accurate tests on a recorder-equipped Southwark-Tate-Emery testing machine. A continuous-line stress-strain curve is plotted simultaneously with each test and complete tests, including records, can be made in as little as four minutes on routine work.

A wide variety of physical testing machines and instruments for both static and dynamic strain measurement and stress analysis is available from Baldwin Southwark in addition to the universal machine.

A complete listing and brief description of our equipment is available in Bulletin K-107. Write for your copy today.

BALDWIN

Southwark

BLW
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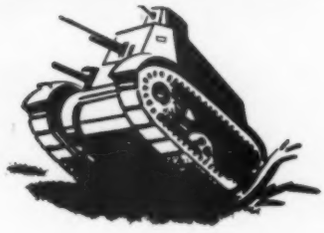
DIVISION OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

PRODUCTION FOR VICTORY

demands cutting oils of proved performance



Cutting oil problems may be new to you. But they're an old story to Cities Service.

Machine operations vary. Some materials are tougher, specifications more exacting. But for every case, the problem is the same — to find the one cutting oil that will give peak performance.

We licked that problem long ago. Not only in the laboratory, but under the severest conditions of day-to-day shop operation. That's why Cities Service can offer you cutting oils of *proved performance.*

Why not get the benefit of our experience? We'll be glad to have a Cities Service lubrication engineer consult with you on your particular job. This service is yours for the asking. Just phone or write our office nearest you, today.

An informative booklet "Metal Cutting Lubrication" is available to the personnel of cutting oil users. Fill out the coupon below and mail for your copy.

OIL IS AMMUNITION — USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.
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Please send me information concerning your Engineers' Lubrication Service. ☐

Please send me your booklet, "Metal Cutting Lubrication." ☐ A. M.

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A LUBRICANT FOR EVERY INDUSTRIAL NEED

LESS TIME FOR REPAIRS...
MORE TIME FOR PRODUCTION

When Your Machines Have VICKERS HYDROMOTIVE CONTROLS

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In addition to the acknowledged reliability of Vickers Hydraulic Equipment, Vickers Control Circuits provide positive and automatic OVERLOAD PROTECTION for the machines to which they are applied. Exact load limitations on these machines can be predetermined and accurately maintained.

Vickers Hydraulic Equipment enables designers to provide machines that will better stand the severe strain of war production . . . unskilled operators, extra shifts and faster operation . . . with the very least maintenance and repair. And the growing scarcity of good maintenance men adds considerably to the importance of this feature.

Vickers Hydromotive Controls offer the designer a wide variety of ways to improve his machines. Vickers Application Engineers will be glad to discuss individual problems.

VICKERS *Incorporated* • 1410 OAKMAN BLVD. • DETROIT, MICH.

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Functio

CONSTANT DELIVERY PUMPS | FLUID MOTORS | VARIABLE DELIVERY PUMPS | FLOW CONTROL VALVES | TRAVERSE & FEED PANELS | SOLENOID OPERATED VALVES | PRESSURE CONTRO

TIME IS SHORT

—save it with Masonite* Die Stock!

Removing formed parts from Masonite Dies at Vought-Sikorsky Division, United Aircraft Corporation

AMERICA must produce in a hurry the swarms of new airplanes needed to give the United Nations control of the skies.

Enlisted in this race against time is the new Masonite Die Stock—a semi-plastic material used in the manufacture of dies for forming sheet metal.

With these dies, the forming and blanking of parts are done in *just one operation*. The combination of Masonite Dies, rubber press pads and pressure results in revolutionary savings of time and slashes cost of fabrication.

Only one-sixth the weight of steel, Masonite Die Stock is easily handled by pattern or tool maker—yet has stiffness, strength and durability for production runs.

While its most spectacular success is being demonstrated in the aircraft industry, Masonite Die Stock is also being used by other fabricators of thin gauge metals to do a faster, better job at less cost and effort.

Masonite Die Stock is available in thicknesses of ¼ to 2 inches . . . in sizes of 48 x 72 inches and 48 x 144 inches. For further details, fill out and mail coupon.

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It's Right MASONITE REG. U.S. PAT. OFF. DIE STOCK

MASONITE CORPORATION *Dept. AM-6,* **111 W. Washington St., Chicago, Ill.**

Please send me illustrated literature and complete information about the new Masonite Die Stock.

Name and firm _____

Address _____

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IT'S A LONG JUMP FROM

BOUDOIR TO FOX HOLE!

SHOCK-

factor in

"... withstood wear and tear of civilian use..."

"... retained its lustrous finish..."

"the Signal Corps required extra durability..."

The molding of telephone handsets may seem far removed from your manufacturing operations. Yet it may be of direct importance, as an example of the problems you may encounter in using plastics for war production.

What happened when the handset used in homes and offices had to be adapted to service in the Signal Corps? Molded from phenolic plastics, the standard handset was sufficiently strong to withstand the wear and tear of everyday civilian use, and it retained its lustrous finish despite constant handling.

But the Signal Corps required

BAKELITE

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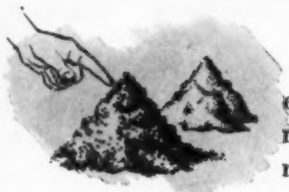
PLASTICS HEADQUARTERS

3 Ways "BAKELITE" PLASTICS

1 LITERATURE ON "DO'S" AND "DON'T'S" OF PLASTICS... Helpful technical booklets containing data on types and forms of BAKELITE plastics, and the most efficient methods of fabrication. This literature will help you to choose the right plastic for each job, save time and avoid errors.

RESISTANCE is now the prime selecting plastics for strategic service!



"specifications . . . called for another type of material . . ."

". . . high impact plastic required higher pressures . . ."

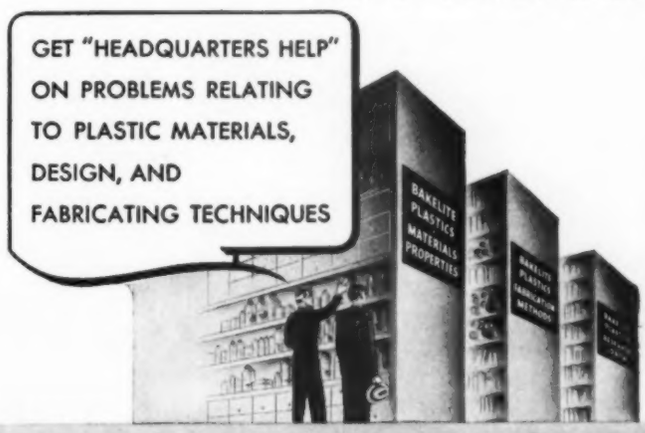
"study . . . avoided errors that might have slowed production . . ."

extra durability, to meet much more exacting service requirements. Specifications were changed, calling for another type of phenolic molding material providing much greater resistance to shock. Use of this high-impact plastic made it necessary to build stronger molds, to withstand considerably higher molding pressures. This, in turn, brought about important modifications in molding technique.

This careful study of problems relating to plastics materials, design, and fabricating techniques avoided manufacturing errors that might have slowed production and wasted valuable material. As a result, production maintained at a high level, and the molded handset provided satisfactory field performance

"prevented waste of valuable plastics materials"

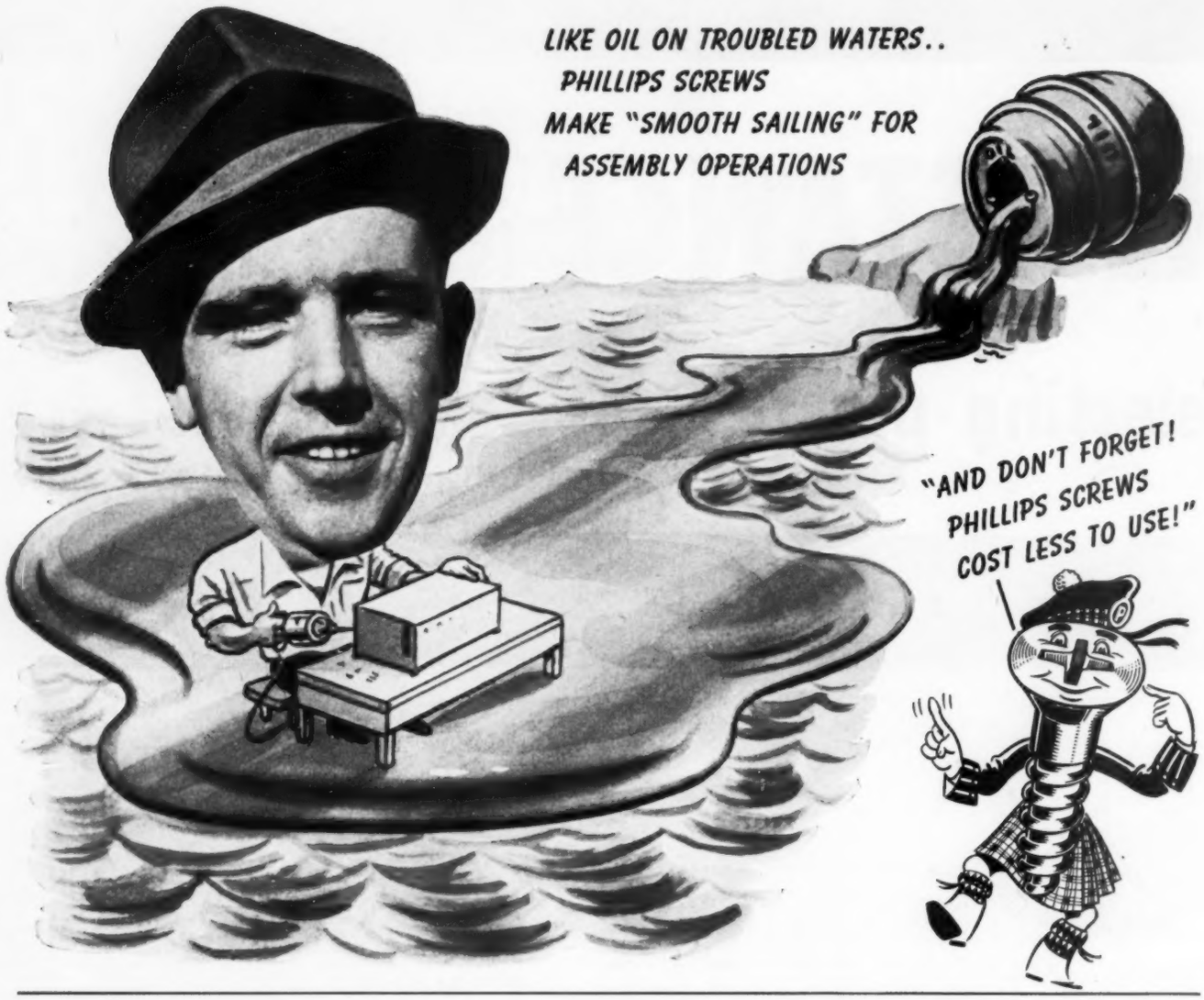
BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York, N.Y.


GET "HEADQUARTERS HELP" ON PROBLEMS RELATING TO PLASTIC MATERIALS, DESIGN, AND FABRICATING TECHNIQUES
BAKELITE PLASTICS MATERIALS PROPERTIES
BAKELITE PLASTICS FABRICATION METHODS

HEADQUARTERS Can Help You Speed Production and Conserve Strategic Material

2 GEARING OUR LABORATORIES TO YOURS . . . Bakelite Laboratories offer a two-fold service. They are ready to help you utilize present plastics in war production. They will also develop new formulas to help solve the problems of highly specialized requirements.

3 FIELD WORK ON "FRONTLINE" JOBS . . . Located at important industrial centers throughout the nation, Bakelite Field Engineers are ready to give prompt service to manufacturers engaged in war production. Fully qualified, they can frequently solve production problems on the spot.



Rapid Driving • No Slipping • Better Holding = 50% Less Assembly Time with Phillips Screws

Here's the formula for doubling fastening schedules: Replace slow-driving slotted screws and awkward hand-driving methods with Phillips Recessed Head Screws and pneumatic or electric drivers. Phillips screw and driver fit as one, making easier, fumble-free driving with no danger of driver slipping from recess to mar surface or cause injuries.

Slotted screw bottlenecks — crooked screws — split heads — burrs — all the slotted screw headaches that waste so much time and effort are eliminated. Work goes smoothly when you replace snail-paced slotted screws with lightning-fast Phillips screws.

You'll discover you get 2 hours work done in one — with a 50% saving in *cost* as well.

Contact companies listed below for further facts.

PHILLIPS RECESSED HEAD SCREWS

GIVE YOU 2 for 1 (SPEED AT LOWER COST)

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS • SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

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The Bristol Co., Waterbury, Conn.
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International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
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Pawtucket Screw Co., Pawtucket, R. I.
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Whitney Screw Corp., Nashua, N. H.

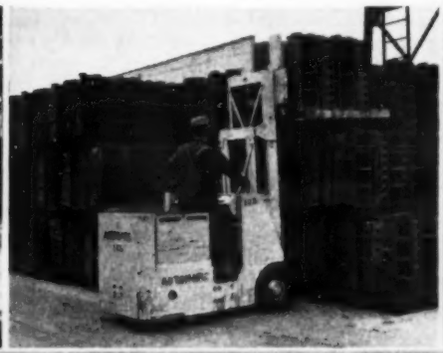
FIRST ALL "E" Navy for INDUSTRIAL TRUCK PRODUCTION

We are proud of the honor and distinction of being the first Industrial Truck producer to be awarded the coveted Navy "E" for Production Achievement.

It is, indeed, a signal honor to fly the Navy "E" Pennant from our flagstaff and for each employee to wear the Navy "E" Badge — both serving as a recognition for a job "Well Done" and also as a reminder of the demands for quality equipment and utmost production.

AUTOMATIC TRANSPORTATION CO.
Div. of The Yale & Towne Mfg. Co.
59 West 87th Street, Chicago, Illinois

TRANSPORTER—Power Drive Hand Lift Trucks



Telescopic Fork Lift Trucks

Low Lift and High Lift Platform Trucks

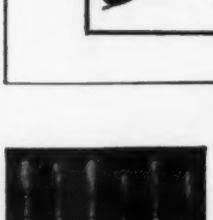
TRADE **AUTOMATIC** MARK

Manufacturers for Over Thirty Years

Electric Propelled **INDUSTRIAL TRUCKS**

POP'S HOT FOR THE "Make 'em last longer" IDEA

TH' GUY WHO LEFT THAT NICHOLSON FILE OUT HERE TO RUST BETTER DUCK DOWN IN HIS BOMB SHELTER!-- POP'S JUST HIT BOILING POINT!
YEH!-- DON'T NOBODY LIGHT A MATCH!- TH' OL' MAN'S HIGH EXPLOSIVE ON THE SUBJECT OF NEGLECTED TOOLS!
WITHOUT LOOKIN' AT NO CRYSTAL BALL, I KIN TELL WHAT A CERTAIN WAR WORKER IS IN FOR! I KIN EVEN SMELL TH' SULPHUR AN' BRIMSTONE!



NEGLECT or abuse of files wastes fine tool steel . . . slows up war production. To get the most out of files, the efficient shop management will impress upon workers these rules of proper use and care:

- Use *The right file for the job.*
- Never "tear" into the work with too much pressure on the forward, or filing, stroke.
- Never "drag" the file back under needless pressure.
- Don't throw files into a drawer or tool box containing other tools or objects.
- Files should never be laid on top of or stacked against each other. Keep them separate—either standing with tangs in holes or hung on a rack by their handles.
- Keep files in a dry place so rust will not corrode their cutting edges.
- Keep files clean of filings or "chips." After every few strokes tap the file on the bench to loosen the chips. File teeth should also be brushed frequently with a file brush or card—and always before putting the file away.

The better the file the greater the reward of care. Nicholson and Black Diamond brands are of the highest quality—made to serve long under normal circumstances, still longer under proper care. *Twelve perfect files in every dozen* is the Nicholson guarantee. Consult your mill-supply house.

BRASS FILE *(Illustrated)*—One of many Nicholson Special Purpose Files. Short upcut angle with *very fine* and long-angle overcut. Made to prevent "grooving" in soft metal, break up filings, and enable file to clear itself of chips. *FREE TECHNICAL BULLETIN.*

NICHOLSON FILE CO., Providence, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

LET'S GO! U.S.A. · KEEP 'EM FLYING!

NICHOLSON FILES

FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.

SMOOTHER OPERATION FOR WAYS

IMPROVES MACHINE PRODUCTION 4 WAYS

• LUBRICATION of machine ways and guides is a small detail in maintenance, but it can be an important factor in machine production. To do this job better, Standard Oil has developed a special line of oils.

When ways and guides tend to chatter or stick where straight mineral oils are used, the specially compounded Stanolex Oils will give one or more of these advantages:

Let a Standard Oil Engineer test Stanolex Oil on just one machine in your plant. Let the machine operator tell you how much difference it makes.

Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

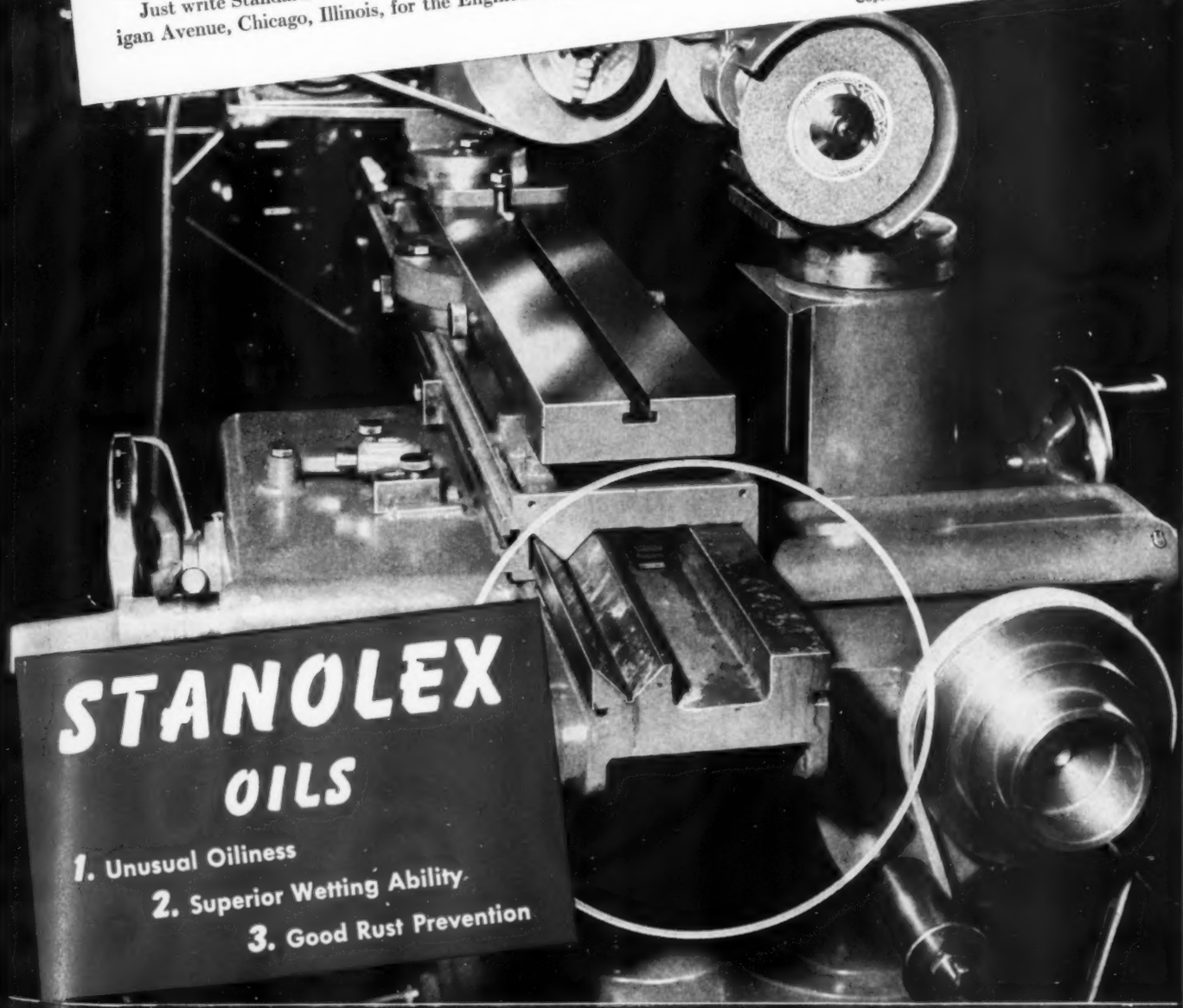
1 **FINER FINISHES** without the need for an additional grinding operation to remove tool marks.

2 **GREATER ACCURACY,** particularly on hand-fed operations where sticking ways handicap the operator.

3 **LESS OPERATOR STRAIN** where wheels or tools must be fed to the work by hand.

4 **LONGER MACHINE LIFE,** not only in the ways and guides, but in gears and feed mechanisms on tables and tools or wheels.

Copr. 1942, Standard Oil Company



STANOLEX OILS

1. Unusual Oiliness
2. Superior Wetting Ability
3. Good Rust Prevention

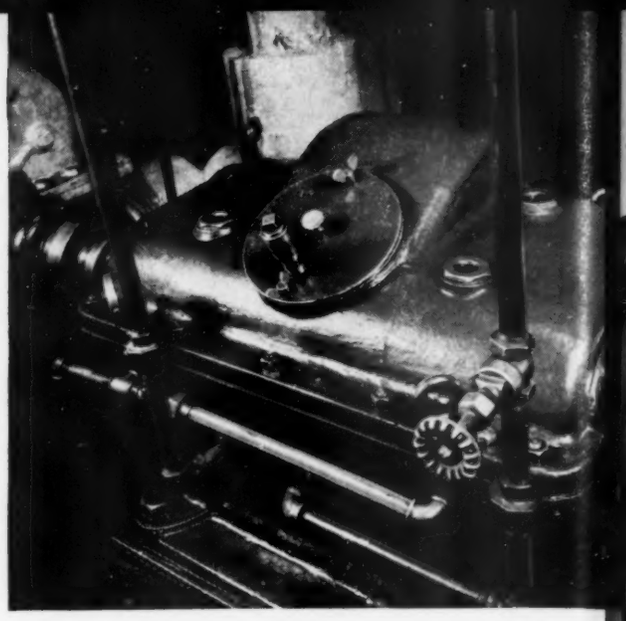
STANDARD OIL COMPANY (INDIANA)

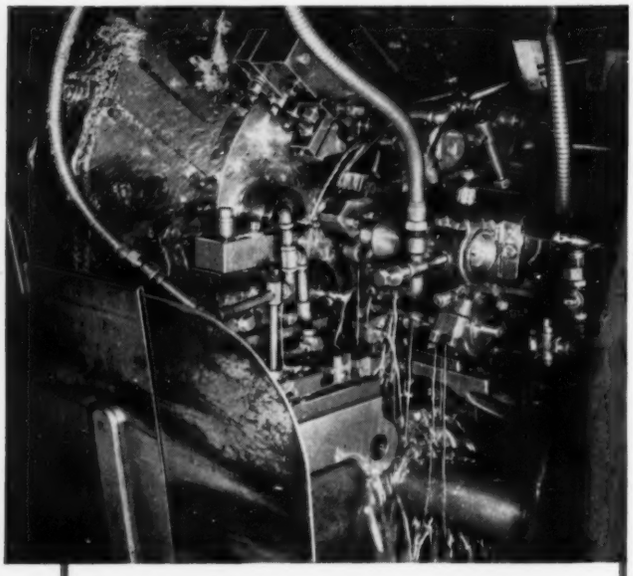
LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION

MUNITIONS MAKER REDUCES STAMPING REJECTS WITH STANOSTAMP

Deep drawn steel and heavy brass cups formed a large part of the operations in a certain munitions plant. Periodically, scratches appeared on the work. Again, the bottoms of the cups were pierced by the die. Both piled up waste when they occurred.

The stamping compound was mixed at the plant. Various changes were made, other products were tried; but the trouble continued, until a Standard Oil Engineer saw the job. Stanostamp was tested on his recommendation. It not only helped to eliminate rejected parts and waste, but die life was materially increased, and rusting of steel parts was entirely eliminated.





HOW TO KEEP CUTTING OILS ON THE JOB

Where a cutting oil or coolant is applied to the work is almost as important as *what* is used. A few minutes spent on these simple checks may save many hours of tool life.

- Check all oil nozzles to be sure that they direct the flow of oil where it will cool the tool and work most efficiently.
- Check operators periodically to be sure that oil nozzles are returned to the right position after each work or tool change.
- Check oil lines for cleanliness to assure an ample flow of oil at all times.

Check with a Standard Oil Engineer when there is any doubt about how an oil should be applied.

OIL IS AMMUNITION . . . USE IT WISELY

Copr. 1942, Standard Oil Company

CUT SHUTDOWNS ON REDUCTION GEARS WITH STANOIL

A North Dakota power company saved both time and money on the reduction gear pictured above. With a conventional oil, sludge formed in the units every three to six months. Then a fill of Stanoil was tried. It ran a full year before it was replaced. Even then, no deposits had formed and the oil was in good condition.

Savings in oil costs—just count them as incidental, if you wish. But think of the production time you'd save if your reduction gears and oil circulating systems operated two to four times as long before they needed cleaning.

Discuss some of your maintenance problems with a Standard Lubrication Engineer. See if he hasn't a number of suggestions about lubrication that will help you cut down lost machine time.

TO HELP YOU GET VICTORY PRODUCTION . . . .

As a means of conserving the machines and tools of industry so vital to Victory Production, Standard Oil Company (Indiana) urges plant officials to take advantage of the Lubrication Engineering Service that is available to all manufacturers in the Middle West.

Demands on equipment have been stepped up—lubricating requirements have changed. Lubricating problems similar to those in your plant may have been solved by these Engineers just a week or a month ago in other plants. You can have the advantage of their up-to-the-minute information on lubrication and lubricant developments at no cost to you. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO
Denver

ILLINOIS
Chicago
Decatur
Joliet
Peoria
Quincy

INDIANA
Evansville
Indianapolis
South Bend

IOWA
Davenport
Des Moines
Mason City

KANSAS
Wichita

MICHIGAN
Detroit
Grand Rapids
Saginaw

MINNESOTA
Duluth
Mankato
Minneapolis

MISSOURI
Kansas City
St. Louis
St. Joseph

MONTANA
Billings

NORTH DAKOTA
Fargo

SOUTH DAKOTA
Huron

WISCONSIN
Green Bay
La Crosse
Milwaukee

WYOMING
Cheyenne

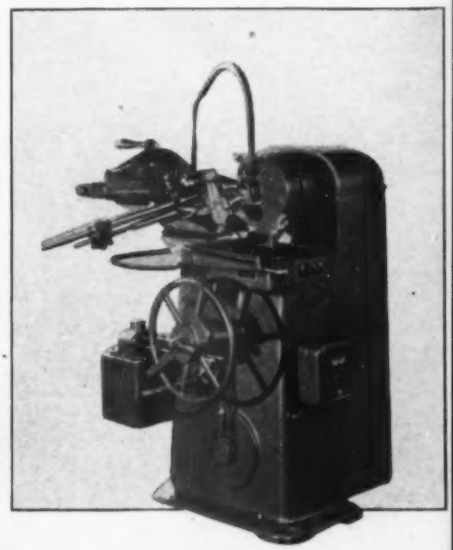
LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION E

STANDARD OIL COMPANY (INDIAN

Grind 'em Right -and FAST

Drilling operations today must be kept on a continuous production basis. Worn drills, therefore, must be ground *right*—and *quickly!* With drills ground on Sellers Drill Grinders you eliminate under- and oversize holes, because the drills are ground accurately . . . you increase production, because drills remain sharp longer . . . you lengthen drill life, because less material is ground away . . . you cut set-up time on multiple spindle machines since drills are ground to equal lengths and sets of drills can be replaced without individual spindle adjustment . . . and production is speeded up, because *accurate* drilling requires no bushing or reaming.

WILLIAM SELLERS & CO.
INCORPORATED
1610 HAMILTON STREET
PHILADELPHIA, PA.



Sellers

they watched

their bearings

"like a hawk"

until they switched to Tycol Green Cast Grease

This manufacturer had been experiencing numerous difficulties with the grease previously used on his centrifugal boiler pumps and the bearings on his chain stokers. On the advice of a Tide Water engineer they switched to Tycol Green Cast Grease. Since then the nuisance of having to keep an eagle eye on the grease job has been eliminated. Now they just put in Tycol Green Cast Grease and forget it. One less item to worry about — the grease stays put and does an economical and dependable job of lubricating.

Tycol Green Cast Grease can effect economies in your plant, too, because this modern grease is made from a paraffine base cylinder oil combined with a minimum of soap. More oil — less soap — means better lubrication.

Let a Tide Water engineer show you where and how improved lubrication can step up production. Write the Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y. Assistance is freely offered.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

INDUSTRIAL TYCOL OILS-GREASES

TIDE WATER ASSOCIATED OIL COMPANY EASTERN DIVISION
17 Battery Place, New York
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

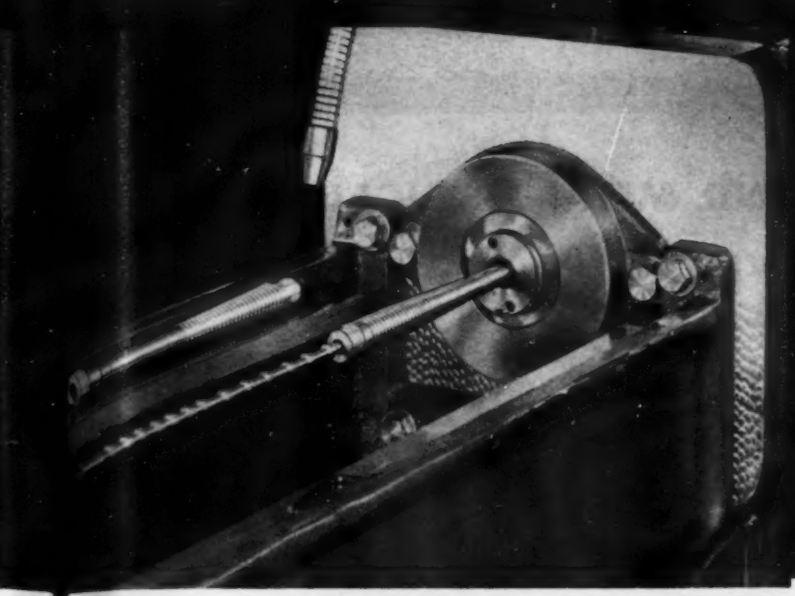
MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

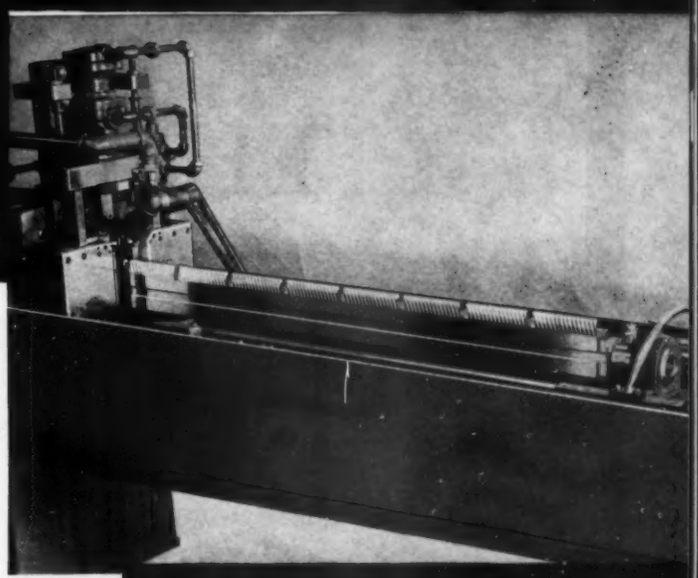
APOI

Shows New on Aircraft

Broaching—always a high speed operation — has been made by Lapointe engineers into a precision operation as well. Cooperating with ordnance officers and aircraft production executives, Lapointe has developed methods of producing complicated parts for aircraft guns and small arms, rapidly and to a degree of precision that checks with the exacting requirements for aircraft engine parts, anti-aircraft gun breech blocks, machine gun barrels and similar war production jobs. Furthermore, modern Lapointe broaching methods have even increased the speed of already rapid operations, making it possible to produce essential war material faster—in some

LAPOINTE MACHINE





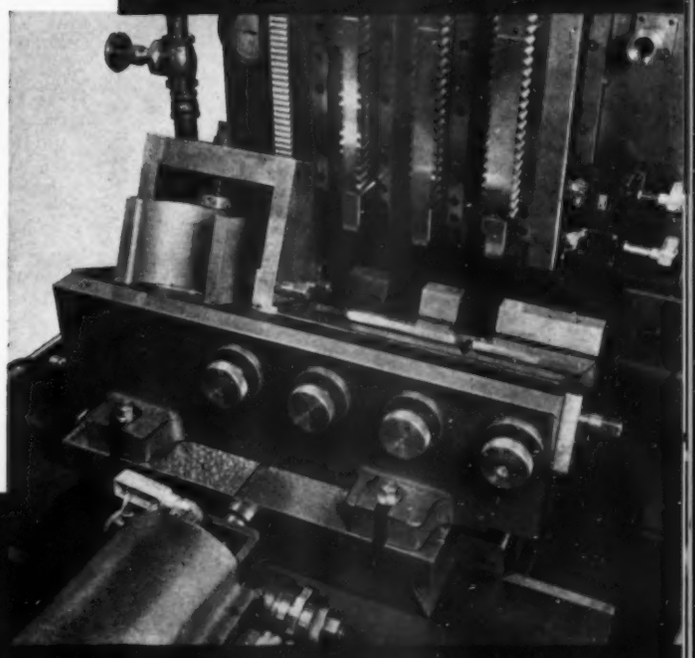
NTE

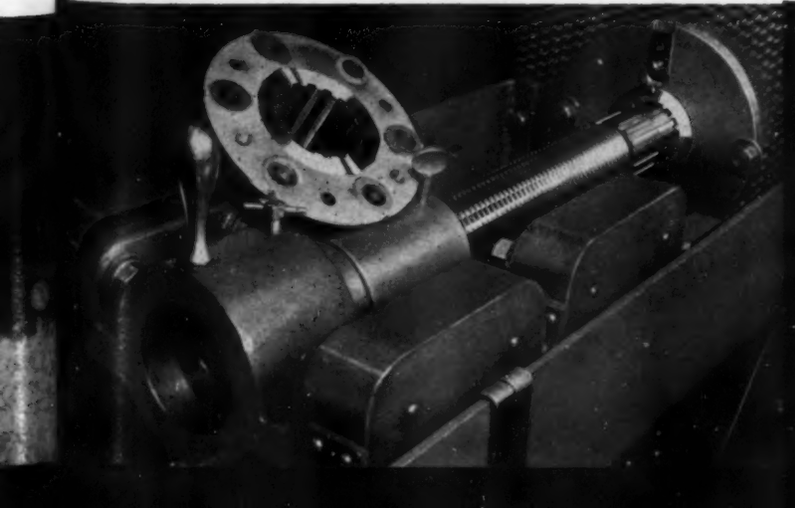
Speed and Accuracy and Munitions Jobs

cases **15 times** faster—than by any previous method. Difficult, tedious jobs have been converted into fast, accurate, "one machine" operations.

Lapointe engineers are constantly widening the field of broaching until the applications now include a range of jobs from small pistol barrels to parts for large guns weighing approximately 1000 pounds. Let us study your new war production problem and show how you can increase speed and accuracy in the production of flat, curved or irregular surfaces, cylindrical work such as gun parts and other jobs of munitions production that require speed and accuracy.

TOOL COMPANY, Hudson, Mass.





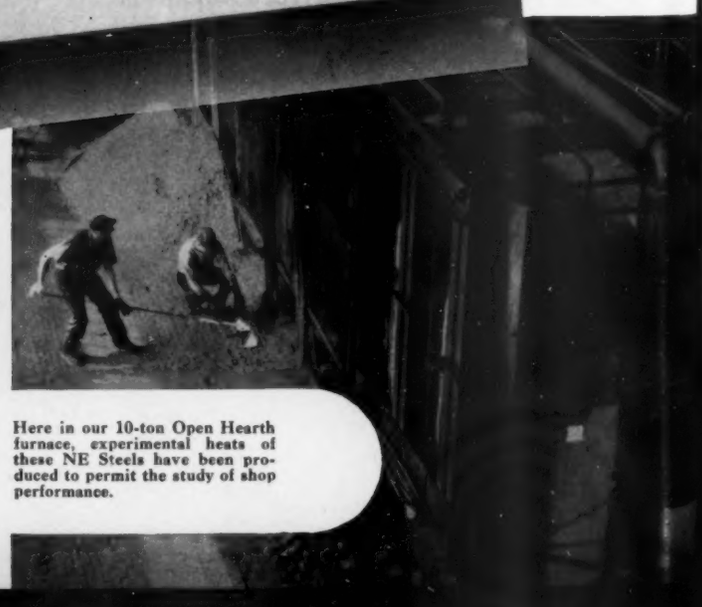
THE SAME FACILITIES AND METALLURGICAL SKILL THAT HELPED DEVELOP

THESE "National"

ALTERNATES FOR CONSTRUCTIONAL ALLOY STEELS

Description	C	Mn	Mo	Ni	Cr	Si
NE 8024	0.22/0.28	1.00/1.30	0.10/0.20	.....	.....	0.20/0.35
NE 8124	0.22/0.28	1.30/1.60	0.25/0.35	.....	.....	0.20/0.35
NE 8233	0.30/0.36	1.30/1.60	0.10/0.20	.....	.....	0.20/0.35
NE 8245	0.42/0.49	1.30/1.60	0.10/0.20	.....	.....	0.20/0.35
NE 8339	0.35/0.42	1.30/1.60	0.20/0.30	.....	.....	0.20/0.35
NE 8442	0.38/0.45	1.30/1.60	0.30/0.40	.....	.....	0.20/0.35
NE 8447	0.43/0.50	1.30/1.60	0.30/0.40	.....	.....	0.20/0.35
NE 8547	0.43/0.50	0.70/0.95	0.40/0.60	0.40/0.60	0.40/0.60	0.20/0.35
NE 8620	0.18/0.23	0.70/0.95	0.15/0.25	0.40/0.60	0.40/0.60	0.20/0.35
NE 8630	0.27/0.33	0.70/0.95	0.15/0.25	0.40/0.60	0.40/0.60	0.20/0.35
NE 8724	0.22/0.28	0.75/1.00	0.20/0.30	0.40/0.60	0.40/0.60	0.20/0.35
NE 8739	0.35/0.42	0.75/1.00	0.20/0.30	0.40/0.60	0.40/0.60	0.20/0.35
NE 8744	0.40/0.47	0.75/1.00	0.20/0.30	0.40/0.60	0.40/0.60	0.20/0.35
NE 8749	0.45/0.52	0.70/0.95	0.30/0.40	0.40/0.60	0.40/0.60	0.20/0.35
NE 8817	0.15/0.20	1.00/1.30	0.30/0.40	0.40/0.60	0.40/0.60	0.20/0.35
NE 8949	0.45/0.52					
A 4023	0.20/0.25	0.70/0.90	0.20/0.30	.....	.....	0.20/0.35
A 4024	0.20/0.25	0.70/0.90	0.20/0.30	.....	.....	0.20/0.35
A 4027	0.25/0.30	0.70/0.90	0.20/0.30	.....	.....	0.20/0.35
A 4028	0.25/0.30	0.70/0.90	0.20/0.30	.....	.....	0.20/0.35
A 4032	0.30/0.35	0.70/0.90	0.20/0.30	.....	.....	0.20/0.35
A 4037	0.35/0.40	0.75/1.00	0.20/0.30	.....	.....	0.20/0.35
A 4042	0.40/0.45	0.75/1.00	0.20/0.30	.....	.....	0.20/0.35
A 4047	0.45/0.50	0.75/1.00	0.20/0.30	.....	.....	0.20/0.35
A 4063	0.60/0.67	0.75/1.00	0.20/0.30	.....	.....	0.20/0.35
A 4068	0.64/0.72					
A 9255	0.50/0.60	0.70/0.90	.....	.....	.....	1.80/2.20
A 9260	0.55/0.65	0.70/0.90	.....	.....	.....	1.80/2.20

In this laboratory-produced test ingot you see the beginning of one of the new NE Alloy Steels specially created to meet the needs of the war emergency.



Here in our 10-ton Open Hearth furnace, experimental heats of these NE Steels have been produced to permit the study of shop performance.

"Emergency" STEELS

ARE HERE TO ASSIST YOU IN APPLYING THEM MOST EFFICIENTLY

HERE we list the National Emergency Alloy Steels, known as the NE-8000 Series—manganese molybdenum and low chromium, nickel, molybdenum steels — developed to conserve strategic alloying elements.

Listed, too, are standard A.I.S.I. steels containing no chromium or nickel, which are also being adopted in this conservation program.

The use of these steels may require changes in established methods of fabrication, or in heat-treatment procedures, or in both. It may even require changes in engineering design. Certainly it will involve careful study in selecting these steels to suit your particular fabricating operations. We are prepared to help you meet this situation with the least dislocation of your present procedure.

It was gratifying to us of Carnegie-Illinois to be called upon to make a major contribution in the development of the National Emergency Steels. But their successful development, we believe, also entails a definite responsibility on our part to assist industry, as far as possible, in *applying* these steels successfully. This we are glad to do—and to the fullest extent of our capabilities.

U·S·S CARILLOY ALLOY STEELS

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

MOLYBDENUM · TUNGSTEN · BORON

MCA

Boron has joined the Alloys!

Tungsten, Molybdenum, Boron—Boron, Molybdenum, Tungsten—interest concentrates now on one alloying element, now on another, as of crucial importance for the war. Very marked attention is at present given to Boron, because of new knowledge that has recently been brought to light.

Minute additions of this relatively abundant element, to steels and irons, yield properties otherwise obtained only by use of scarcer imported materials. One specific advantage in many cases is deep penetration of hardening effects, accompanied by an increase of yield and ultimate strength.

Researches on Boron have been conducted for some time by the Molybdenum Corporation of America and more recently verified under a fellowship at a leading university. A patent for the effective incorporation of Boron in irons and steels has been secured and its results will be made available to any American manufacturer. Inquiries are welcomed.

AMERICAN Production, American Distribution, American Control—Completely Integrated.
Offices: Pittsburgh, New York, Chicago, Detroit, Los Angeles, San Francisco, Seattle.
Sales Representatives: Edgar L. Fink, Detroit; H. C. Donaldson & Co., Los Angeles, San Francisco, Seattle.

MOLYBDENUM

CORPORATION OF AMERICA, Grant Building, Pittsburgh, Pa.

A big promise—to increase grinding production 2 to 5 times—yet you can easily prove it!

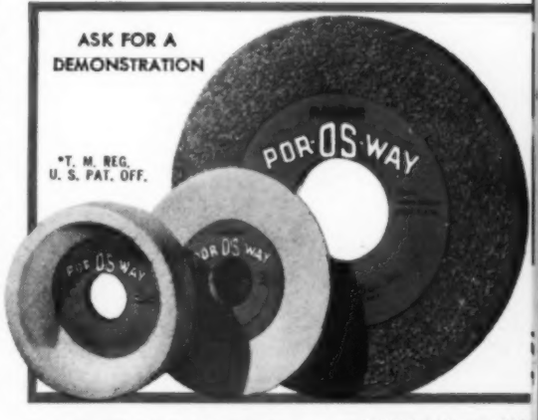
NEW IN PRINCIPLE, new in results, Por-os-way is different from any grinding wheel you have ever used. Instead of being sandy or compact, the structure is stringy and porous, like a sponge. The cellular structure, the new bond used, permit faster, cooler, free cutting!

In actual operation, Por-os-way cuts 100% to 400% faster. Deeper cuts are possible . . . .010" or more. Burning is practically eliminated. This is why the wheel, even in inexperienced hands but properly used, increases production per man, per machine 2 to 5 times.

You can prove these results on your own machines. Try Por-os-way on hard tool steels. Try it on copper, tin, wood, and plastics. Loading is reduced to a minimum. The wheel holds the corner and requires very little dressing.

See this new wheel! Por-os-way, developed after three years research by a firm that has specialized in precision grinding for years, is helping greatly to speed up war production. Make a test on your job. Write today for booklet that "tells all". A. P. DE SANNO & SON, INC., 430 Wheatland St., PHOENIXVILLE, PA.

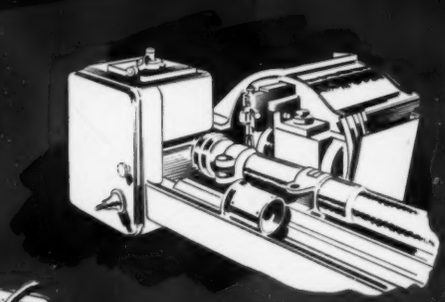
POR-OS-WAY* *a new* RADIAC* PRODUCT



Copyright 1942 by A. P. DE SANNO & SON, INC. (TURN PAGE, PLEAS

GRINDS ALMOST EVERY WAY BETTER!

TRY THE AMAZING NEW POR-OS-WAY* WHEEL



FOR SHARPENING TOOLS AND CUTTERS

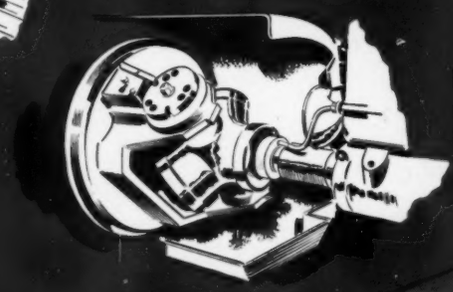
Milling cutters, taps, drills, hobs, reamers, lathe tools, broaches, dies, and thread chasers.

FOR INTERNAL GRINDING

Such jobs as valves, bushings, rollers, armatures, bearings, pinion gears, piston rings, collars.

FOR CYLINDRICAL GRINDING

Including bushings, valve guides, bearings, tubes, shafts, plug gauges, pistons, drills, rollers, commutators.

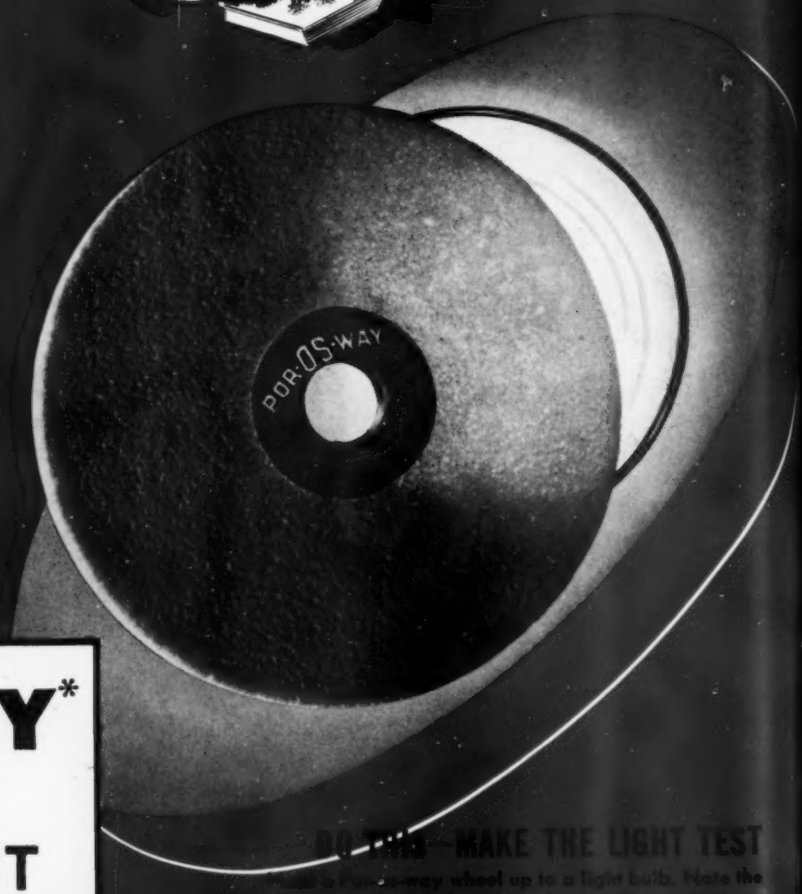


FOR SURFACE GRINDING

Forming tools, castings, blades, punches, forgings, gauges, fixtures, Stellite and hardened tools and dies.

Por-os-way is cooler, free cutting, 2 to 5 times faster. See for yourself!

THIS is the wheel that even skilled grinders say is almost too good to be true. Why? Because it bites through hard tool steel 2 to 5 times faster, takes double or triple the regular cut or more, with practically no vibration, practically no risk of "burning". Yet Por-os-way is equally efficient in grinding copper, tin, rubber, plastics and softer materials . . . even wood. It reduces loading to a minimum. See, try this new wheel. Write for new Por-os-way booklet that "tells all" and includes a "prescription" blank for your own application.



DO THIS—MAKE THE LIGHT TEST

Hold a Por-os-way wheel up to a light bulb. Note the even spread of light. No soft spots to wear away quickly, no dense spots to encourage glazing. The light is evenly diffused. The uniform structure of the wheel gives you uniform wear.

POR-OS-WAY* a new RADIAC* PRODUCT

A. P. DE SANNO & SON, INC., 438 Wheatland Street, PHOENIXVILLE, PENNA. • SINCE 1893
Offices and Warehouses in Pittsburgh, Cleveland, Detroit, Chicago, Los Angeles

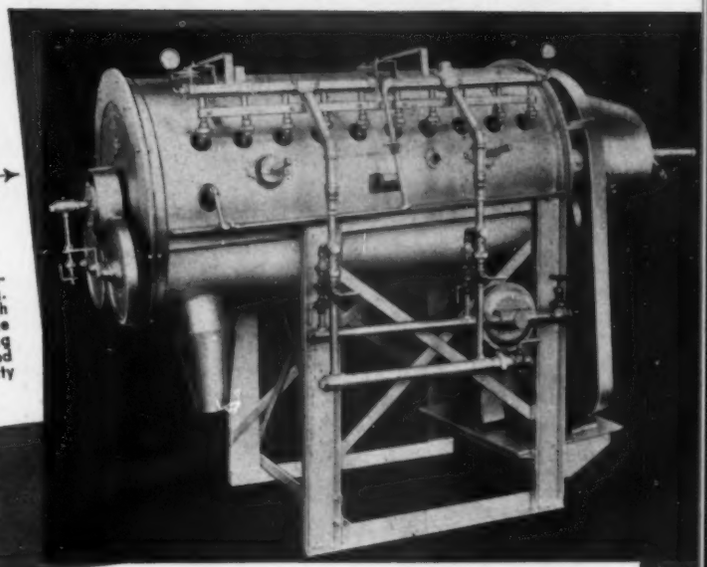
AMERICAN GAS FURNACES

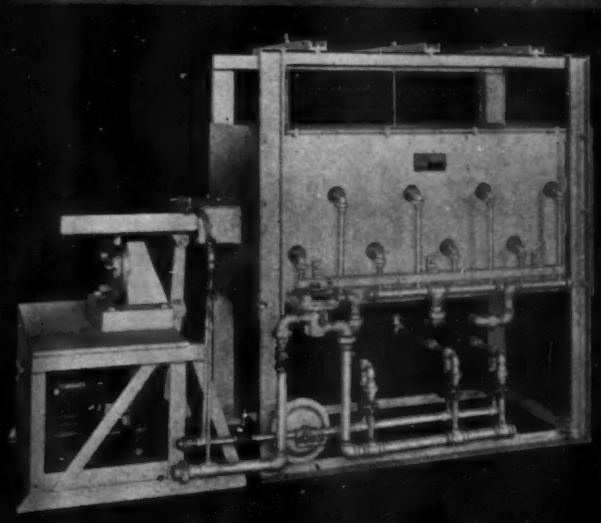
meet today's urgent need for more and better heat treating . . . . . in less time

No. 315 Improved Pot Furnace. Supplied for use with lead, cyanide, neutral salt or carburizing salt as the heating medium. Fast heating; simple control.

No. 136ME Rotary Heating Machine for continuous clean hardening. Extremely high heating efficiency and uniform heating of all work is assured; heating time cycle and temperature can be varied as desired.

No. 176F Reciprocating Heating Machine for continuous clean hardening. A full muffle is provided through which the work travels. Only the work enters and leaves the heating zone. Heating time may be varied by changing force, length or rapidity of stroke.



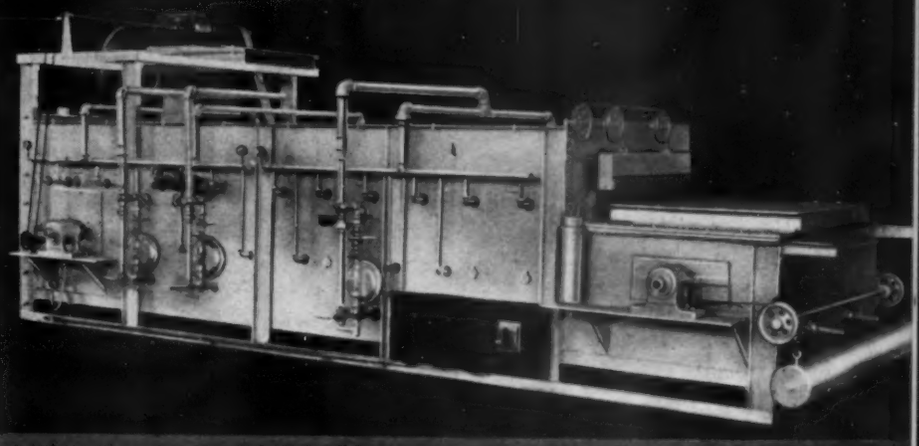


WAR production requirements are being met with modern heat treating equipment pioneered by "AMERICAN GAS." Sixty-four years of experience are behind this complete line of furnaces which can be depended on to perform the heating operations required with uniformly good quality at highest efficiency.

American Gas Furnaces are available in types for a wide range of operations and purposes as well as in a complete size range. A.G.F. engineers stand ready to give you the benefit of their long, specialized experience at all times.

TYPES AVAILABLE

- Conveyor Heating Machines
- Forges
- Oven Furnaces
- High Speed Furnaces
- Pot Furnaces
- Melters
- Reciprocating heating Machines
- Rotary Heating Machines
- Open Flame Heating Machines
- Rotary Tempering Machines
- Special Heating Machines
- Gas Carburizers
- Tube Furnaces
- Cylindrical Furnaces and others



No. 192 Chain Belt Conveyor Heating Machine. Designed for heat treating a wide variety of forgings, including rifle and revolver parts. Over and under firing from both sides insure uniform heating. The return loop of the belt is within the furnace.

AMERICAN GAS FURNACE CO.

Elizabeth, New Jersey

AMERICAN GAS FURNACE CO. PIONEERS 1878

FOR ORDNANCE... AND MACHINES THAT MAKE IT!

» Motor Cars to Munitions . . . a phrase that carries a punch . . . the strong right arm of Uncle Sam's mills behind the men...National-Erie packs plenty of punch furnishing castings and gears of Neloy and Neloy Molybdenum Steel for the Automotive Industry's Motor Cars-to-Munition Miracle. National-Erie also produces Ordnance Parts. (NE) is another Symbol of Uncle Sam's endless Service of Supply... his thousands of thunderbolts to Win the War.

NATIONAL-ERIE

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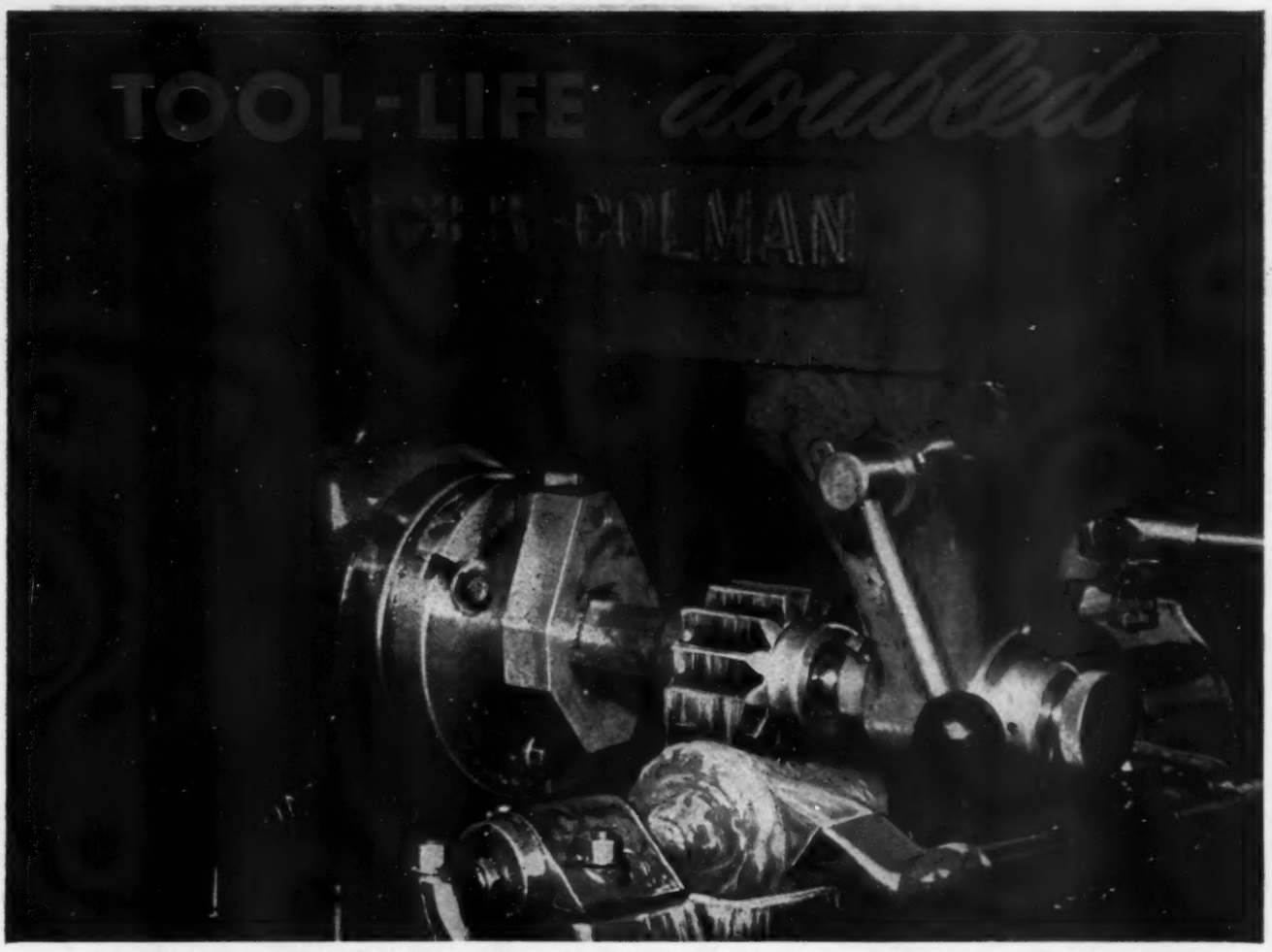

Hob life increased 100% in a job similar to this, when the soluble oil used was replaced by *Texaco Soluble Oil C.*

A WAR production plant's dream comes true. In this plant, twice as many gears hobbed —half as many hobs required. The only change made was to use *TEXACO SOLUBLE OIL.*

Regardless of your requirements, there is a *Texaco Cutting or Soluble Oil* exactly suited to the conditions in your plant . . . assuring you of maximum production, better finish, longer tool life, lower machining costs. The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent users in the metal-cutting field.

Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write:

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★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

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FRED ALLEN every Sunday night. See your local newspaper for time and station.

TEXACO

TEXACO Cutting and Soluble Oils

FOR THE METAL-WORKING INDUSTRY

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Photo—Public Information—Ottawa

DRILLING ski with Black & Decker 3/8" Hornet Drill to install toe-plate. Ski manufacturers use many kinds and sizes of Black & Decker Portable Electric Tools.

SANDING bottom of Mosquito Boat with Black & Decker Heavy Duty Flexible Disc Sander. Black & Decker Tools are used in all building operations on these fleet torpedo boats.

NUT RUNNING on wheelbarrow assembly. Reported time-saving, 50%; production increase, 50%! Black & Decker Tools speed equipment for construction jobs vital to the war production.

Black & Decker Electric Tools Speed All Kinds of War Jobs!

War industry, to most people, means ships and airplanes, guns and tanks. Black & Decker Tools are helping build all these, of course. But there are hundreds of other war supply projects just as important—for example, the ones illustrated on this page.

Through war production jobs, industry is learning a lot of new uses for Black & Decker Electric Tools. Talk to your Black & Decker Distributor. He will be glad to show you what others are doing and may give you some time-saving ideas that can be applied to your own jobs. The Black & Decker Mfg. Co., 716 Pennsylvania Avenue, Towson, Md.

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Black & Decker

PORTABLE ELECTRIC TOOLS

INSTRUMENTS OF VICTORY

The Army Says: "Do a thing; Do it Right; and be Quick about it!" Let American manufacturers adopt that slogan. We have at VARD. And here are three instruments, first developed for our own use, and now offered to you as aids in doing a job, doing it right and doing it Quickly.

The first of these, in the center above, is a circular dividing machine. It accurately divides any circular disc into predetermined segments. It is valuable in production of dials, protractors, and the like. We also manufacture a linear dividing machine for automatic dividing of strip material.

At either side of the divider, in the above picture, are new VARD external comparators, small handy table instruments, for checking limits in manufacturing. One is a dial gauge type. The other is a liquid column reading type. Both quickly indicate variations as small as one ten-thousandth of an inch. Each can handle work quickly. Adjustments are simple and positive.

VARD builds precision gages for checking threads, holes, and thickness. Likewise we produce special taps, optical lenses, prisms, and mirrors. Another branch of our organization turns out aircraft hydraulic units, drafting, and navigating instruments.

The VARD trademark on a product symbolizes thorough engineering, the best in materials, and technical, precision workmanship.

VARD INC. PASADENA, CALIFORNIA, U.S.A. • SUCCESSOR TO VARD MECHANICAL LABORATORY

Some ways to conserve Tool Steel

DO'S AND DON'TS OF FORGING

Conserve tool steel. Every pound of it is vital to war production. By following these suggestions on forging, you can lengthen the service-life of your steel . . . speed up production . . . and help beat the Axis.

The process of forging tool steel may be divided into three steps—(1) heating, (2) forging, and (3) cooling. Each of these steps is important, and must be carefully controlled to get maximum service from the steel.

Heating

Heat the piece to be forged slowly and uniformly throughout. Many tool steels conduct heat slowly, and for this reason, sufficient time should be allowed for heat to penetrate to the center of the piece. It is very important that the piece be heated to the proper temperature before forging.

Preheat the steel in a preheating furnace before bringing it up to forging temperature. This largely eliminates too-rapid preheating and the danger of rupture. It also decreases the time necessary to hold the piece at the higher temperature in the forging furnace. Excessive scaling is prevented. Grain-growth and decarburization are reduced.

If a preheating furnace is not available, warm the steel before putting it into the forging furnace. This can be done by placing the steel on top of the furnace, or on the shelf in front of the charging door so that the chill is removed. The same warming can be carried out if a blacksmith's fire is used.

Forging

Generally speaking, about fifteen minutes of soaking at forging temperature for each inch of greatest thickness is sufficient for carbon steel. This time should be increased to about half an hour for tungsten and high-chromium steels. Experience, together with the equipment available, is the best guide.

Forge with a hammer of sufficient capacity to thoroughly work the steel, but not so heavy as to cause ruptures. All reduction in cross-section should be carried out by going from a square section to a square section. The corners should be knocked down on each reduction. If a round or hexagonal section is desired, the piece should not be brought to the desired shape until the final hot-work operations. When forging rounds, use V-type dies in working down the section from a square. In high-carbon, high-alloy tool steels, this practice prevents center ruptures.

Do not forge at too low a temperature, as cracking will result.

Cooling

Most tool steels will harden in air to a certain extent, and should therefore be cooled slowly and protected from moisture or drafts. To prevent cooling strains, forged parts should be cooled by burying in either dry ashes, lime, or silocel.

If forgings are of intricate shape, such as gooseneck planer tools, spring tools and the like, they should be annealed after forging to remove the stresses set up by forging and cooling. If a previously hardened tool is salvaged by reforging to make a smaller tool, it should be annealed before reforging.

This information is available in the form of a card suitable for hanging in shop or office. No cost or obligation. Write to Bethlehem Steel Company, Bethlehem, Pa.

BETHLEHEM STEEL

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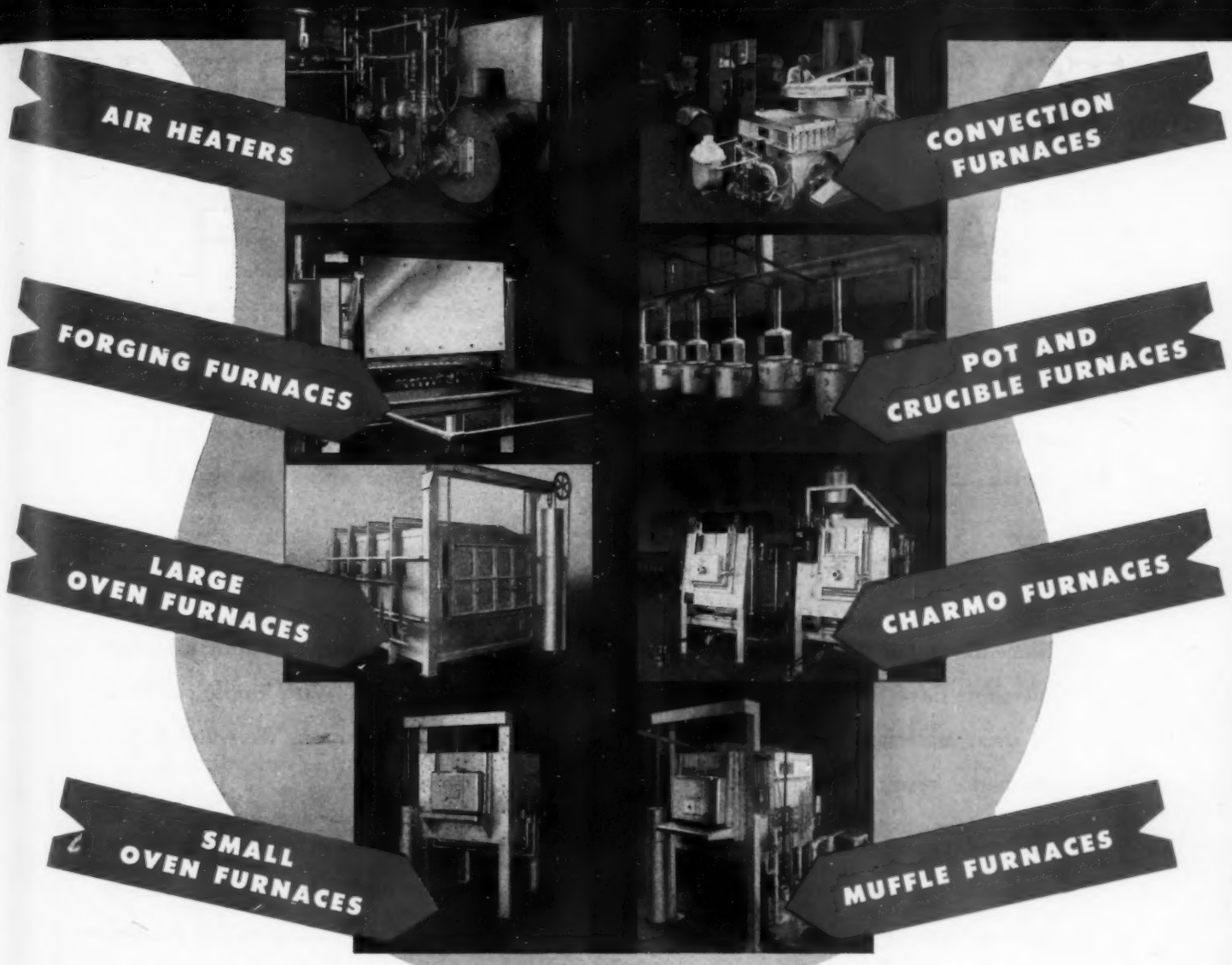

MANY TYPES AND SIZES MEET MOST ANY PRODUCTION DEMAND

● It's quick and easy to select the proper SC Standard Rated Furnace for the desired production, and to determine in advance the cost for every heating operation. All this is possible because Surface Combustion has available 34 different types of Standard Rated Furnaces, each built to standard, thoroughly tested specifications and rated on the basis of actual performance characteristics taken from the engineering records of thousands of installations in operation throughout the entire metal working industry.

All preliminary engineering for SC Standard Rated Furnaces is completed, designs have been drawn, parts are in stock and shipment can be made in short time.

Now, when more and faster production is at a premium, SC Standard Rated Furnaces are meeting the demand with economy and efficiency. Why not state your heating or heat treating problem? We'll mail literature and specifications on the proper equipment to meet the need for stepping-up war production.

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MANUFACTURERS OF INDUSTRIAL FURNACES · JANITROL GAS-FIRED SPACE HEATING EQUIPMENT · AND KATHABAR AIR CONDITIONING SYST

IT'S TIME TO TIGHTEN OUR BELTS ANOTHER NOTCH

Since the end of World War I, thousands of tons of nickel, chromium and other alloying elements have been employed to improve the qualities of steel. With ample supplies of these materials available, little thought was given to conservation. We wanted performance results—we got them.

But today, the picture has changed. We're in another war—a mechanized war—that demands the finest steels ever produced. Nickel, chromium and other substances have become critical alloying elements—because they're needed for *Production for Victory* —and because there just isn't enough immediately available to go 'round.

It's time to start pulling in our belts!

ALLOY and CARBON STEELS • STAINLESS STEEL • PLATES • TIN PLATE • NUTS • BOLTS • RIVETS • NAILS • PIG IRON
BARS and SHAPES • STRIP • SHEETS • PIPE and TUBING • FARM FENCE • WIRE • FABRICATED STEEL PRODUCTS

From the time when we began building for defense—now for victory—Republic has urged its customers to conserve critical alloys, and to cooperate with Governmental requests and restrictions designed for the protection of all.

To aid directly in conservation, Republic has continued its relentless research—its experimenting with new analyses which would save critical alloys, yet provide the qualities needed in steel today.

In most cases, it has been proved that critical elements alloyed in reduced quantities with steel would provide desired qualities when chemistries are properly balanced.

At the same time, Republic has warned customers of probable shortages, and has recommended *changes that eventually must be made.* Assistance has been given in the redesign of sections in preparation for keeping production moving with steels of lower alloy content – without sacrifice of needed qualities in the finished product. Suggestions have been offered on machining, forging and heat treating practices where changes were indicated.

America's greatest danger today is lost time in production. Never before in our history has time been so important. One airplane, gun or ship today may be worth a dozen tomorrow.

Republic is fully aware that its job today and tomorrow is to produce the best steel possible—with the materials available—for each specific need—and, to the utmost of its facilities, in the quantities required.

But Republic feels that this is only part of its duty. Hence, Republic's eagerness to be of greatest assistance to its customers—to help in the selection, application and fabrication of available steels to reach our mutual objective—*More Production for Victory.*

REPUBLIC STEEL CORPORATION

Alloy Steel Division Sales Offices: Massillon, Ohio • General Offices: Cleveland, Ohio

Berger Manufacturing Division • Culvert Division • Niles Steel Products Division
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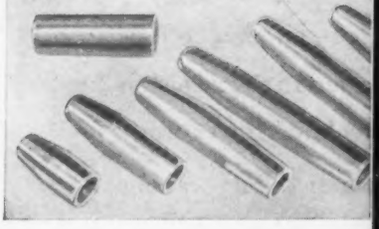
MALLORY STANDARDIZED WELDING ELECTRODES

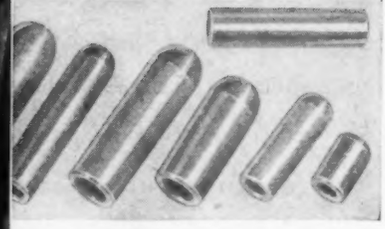
SPEEDIER PRODUCTION

BETTER WELDING

LESS DOWN TIME

LOWER COST





"Canned Lightning" Wins Its Wings

Resistance welding with the "canned lightning" of stored energy machines has certainly won its wings on the production line . . . by permitting more efficient design . . . by assuring faster assembly with fewer men; rivetless and thus lighter structures; and savings in assembly costs up to 90%!

The operator of the spot welding machine above is joining a reinforcing element to the control standard for an airplane wheel column used on a modern warplane. He works faster than a two-man riveting crew . . . and doesn't have to drill holes or use drill jigs or buck rivets. The finished assembly, spot welded, is much less costly, lighter and just as strong and corrosion-resistant as a comparable riveted member.

But modern impulse welding machines and skilled operators couldn't achieve production miracles without the right resistance welding electrodes and holders.

That's where Mallory comes in. Our engineers have spent years of research in the problems of joining many metals and alloys, similar and dissimilar, ferrous and non-ferrous, by resistance welding. We have developed, and production-proved, special electrode alloys and contours, holder designs and cooling methods. We have evolved a standardization program that permits prompt specifying, ordering and shipment of the right electrode and holder for each job . . . for greater speed, more welds between redressings, more welds per electrode, and better resistance welding at lower cost.

Whatever metals you're welding . . . by whatever resistance welding method, spot, seam, flash or butt . . . you'll find that it pays to come to Mallory for the right electrode for each job. Remember, these *standardized* electrodes are available promptly, when you need them.

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Resistance Welding Data Book

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20 TIMES THE PRODUCTION WITH MEEHANITE Shell-Nosing Dies!

The unusual wear-resisting properties of *Meehanite* dies are clearly demonstrated by the service record figure quoted above. The useful life of another cast die was only 18 shells; alloy dies had an average life of only 189 shells; but cast in *Meehanite*, the dies produced an average of 3700 shells, the maximum to date being 4124 shells!

Resistance to wear and abrasion is only one of many advantages possessed by this modern engineered cast metal. Said by designers and casting users to "bridge the gap" between cast iron and steel, *Meehanite* dies offer freedom from galling and scuffing; are readily machinable; have a high compressive strength; are adaptable to heat-treatment and flame-hardening; and possess self-lubricating properties.

Representative *Meehanite* Shell-Nosing Dies made by Cooper-Bessemer Corporation.

Write for Engineering Booklet No. 11—"*Meehanite*, the Metal for Cast-to-Form Dies."

MEEHANITE RESEARCH INSTITUTE, 311 Ross St., Pittsburgh, Pa.

FIGHTING *one production emergency after another?*

Investigate McCASKEY PRODUCTION CONTROL

McCaskey Controls have been developed the practical way, working with thousands of production men in their plants to visualize the data that prevent production emergencies. Needs experienced through more than a score of years have provided the basis of McCaskey systems that are short-cutting red tape and clerical work in numerous war plants. They are providing, for example:

- A simple method of coordinating the flow of finished parts required for assembly to avoid delays resulting from missing parts . . .
- Forecasting production delivery . . .
- Meeting delivery dates promised . . .
- Scheduling machines, determining machine loads and making job assignments so that all machines may be put to work and worked all the time . . .
- Checking machine production to make sure that standards set are realized . . .
- Following-up production without dependence on stock chasers . . .
- Providing day-to-day cost and payroll data for immediate control of unexpected increases . . .

The simplest possible control of production is most essential today. Systems that require numerous stock chasers and production clerks to compile data will lead to difficulty sooner or later. Clerical turnover, already serious, is increasing rapidly.

Let us give you specific information about the application of McCaskey Controls to your requirements and explain how they are provided with a minimum of clerical effort. Experienced representatives are available to analyze your requirements and offer practical recommendations. No obligation. Write today.

Report from well known plant
Using McCaskey production control system

McCaskey Controls enable us to intelligently schedule machine operations and delivery of raw materials and to follow up each operation on hundreds of production orders from a centralized control point. The exact status of any order of the hundreds in process may be determined at a glance without the necessity of employing production chasers.

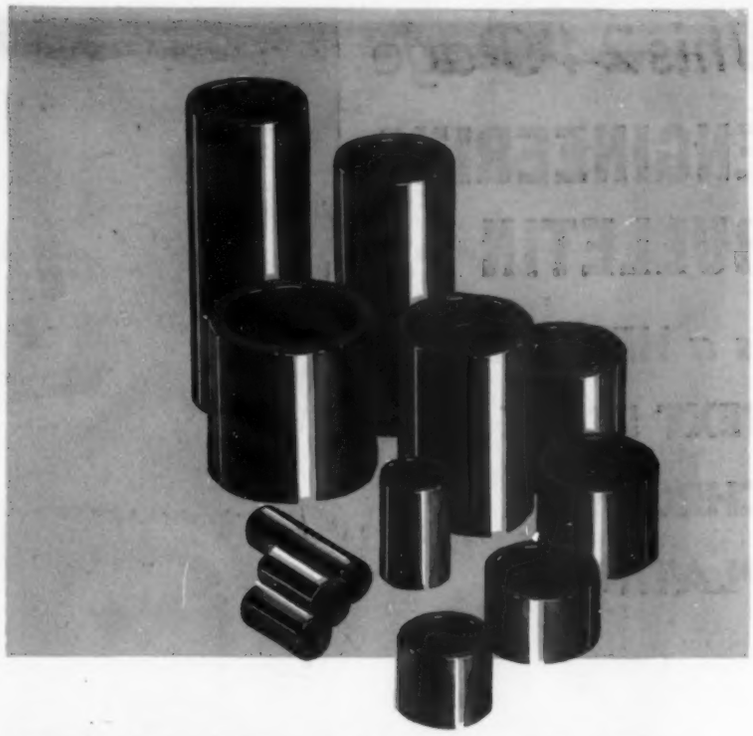
Accurate costs are obtained with very little clerical work. Cost data are almost immediately available, not only when the job is completed but at any time during operation. The system gives us a much closer control of shop orders and enables us to make reliable promises to customers and keep them.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL



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Are you having trouble securing your needs in plain bronze bearings? If so, perhaps we can help you . . . help you with uniform, high quality bronze . . . machine finished, ready for assembly . . . in any quantity—right from stock.

The first step is to compile a progressive list . . . I.D.—O.D.—Length . . . of all the bearings you require. Then compare them as to *size* with our list of GENERAL PURPOSE BEARINGS. The chances are ten-to-one that from our more than 800 sizes, we can fill your needs—right off the shelf. Alterations such as oil grooves, slots, holes, etc. are quickly, easily added.

Our range of over 800 sizes is the result of more than thirty years research into the requirements of machinery manufacturers. Each year, as new sizes are added to new equipment, we place duplicates in stock. The alloy —S.A.E. 64—guarantees the utmost in performance and long bearing life.

Why not eliminate costly delay in your production line by STANDARDIZATION—on Johnson GENERAL PURPOSE BEARINGS? Give us the opportunity to prove our exceptional service . . . the bearings will prove their quality through performance. Write for a copy of our new catalogue—today.

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This ingenious device enables you to tell at a glance if your bearing requirements are stock items. It enables you to carry a list of over 800 sizes in your coat pocket. Write for one.

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This 24-Page

ENGINEERING BULLETIN

***is a* HELPFUL TEXT BOOK *on* CHROMIUM PLATING**

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Yours for the Asking

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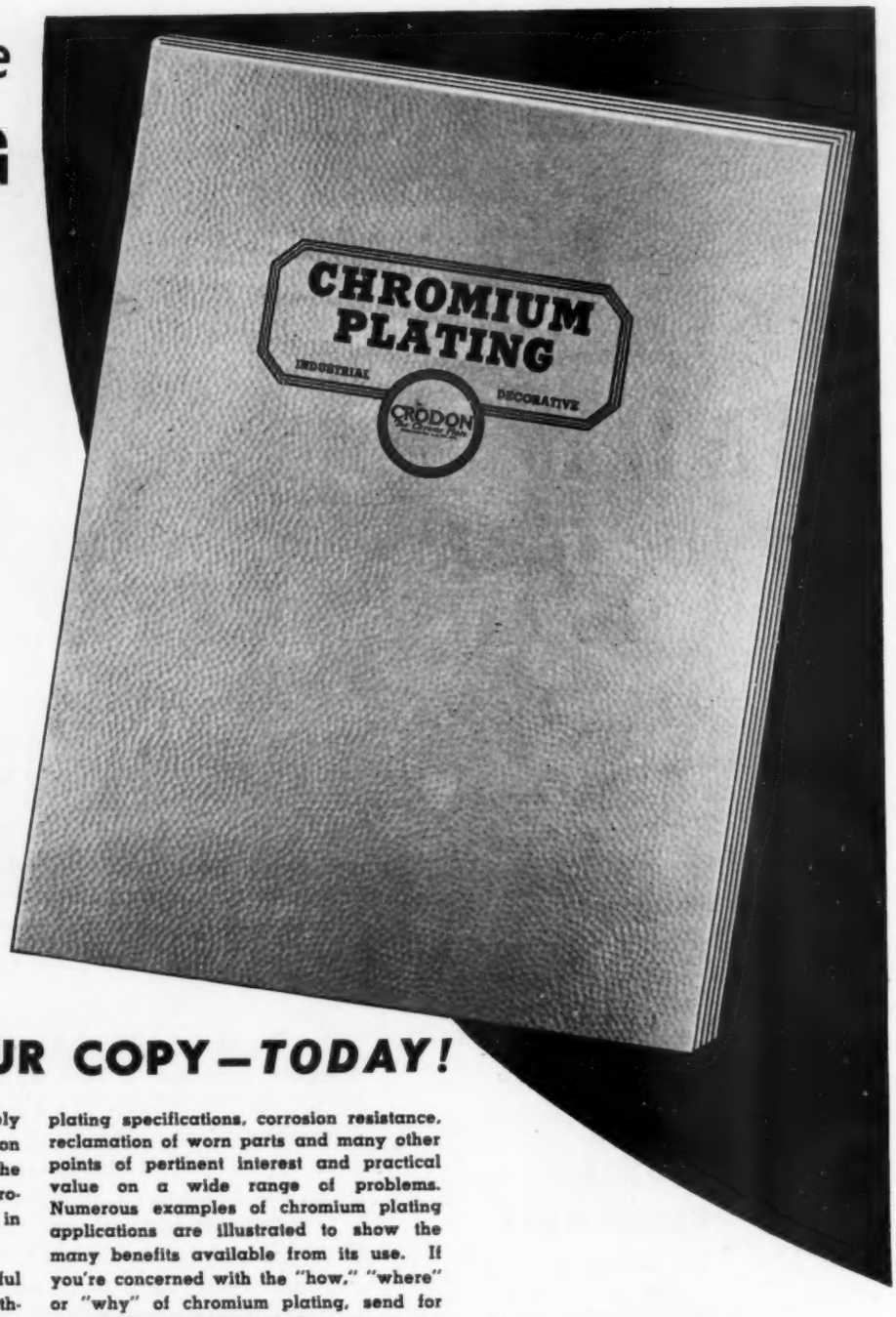

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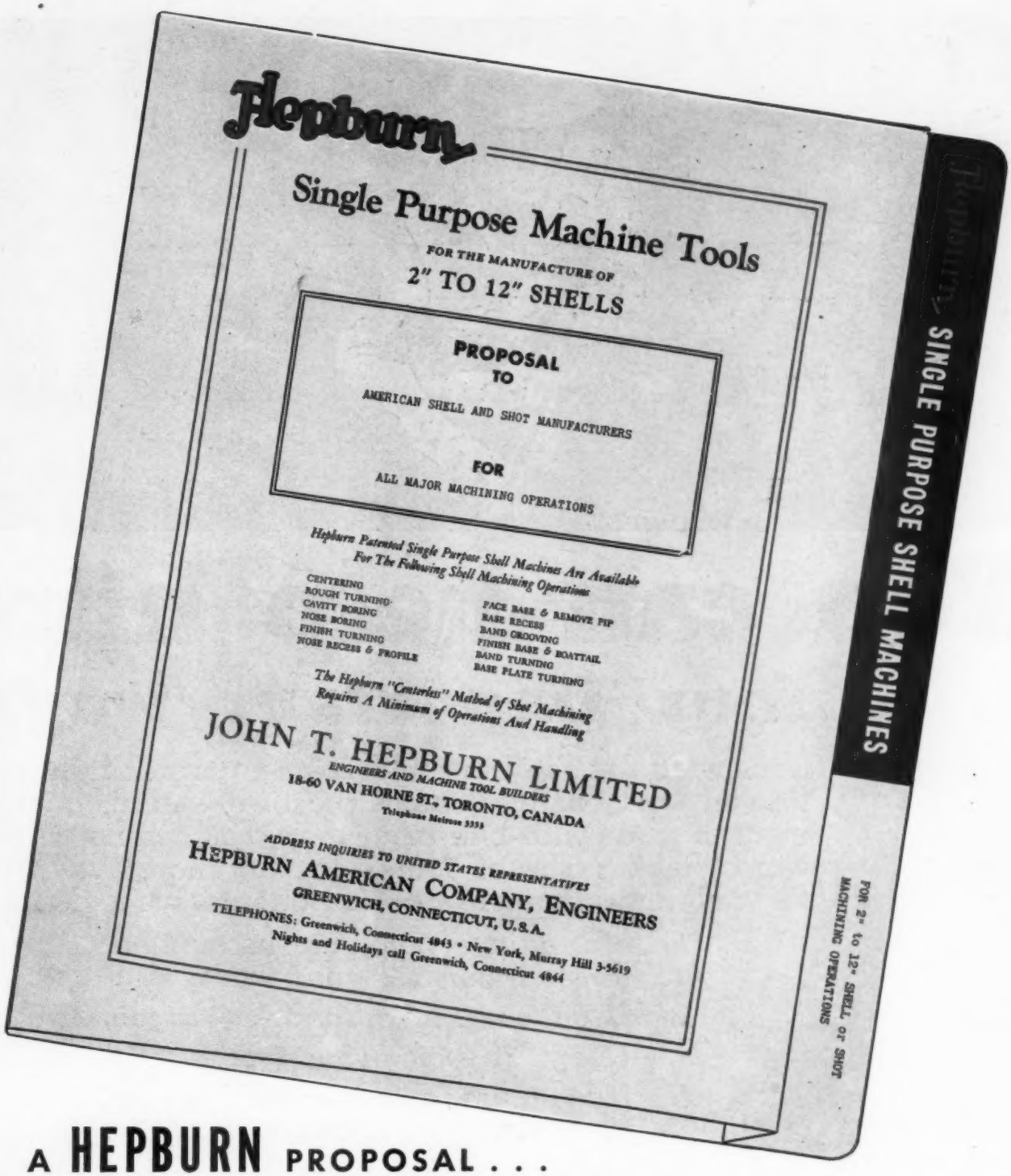
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The Hepburn line includes a series of 32 basic single purpose machine tools engineered for machining each size and type of shell and shot within the size range of from 2" to 12" and equivalent metric sizes.

Hepburn Proposals are available on request only to manufacturers of shell and shot or to companies negotiating for such manufacture.

To conserve time, requests should advise the size and type of shell or shot and the production requirements per hour. They should be addressed to United States Representatives, Hepburn American Company, Greenwich, Connecticut.

Reasonable Deliveries Are Available

You can help him

four important ways

Somewhere at the front you have a partner fighting for you – personally. Because practically all his equipment is made with fine hand tools, you can help him win by taking care of yours – leaving more available for vital war work. Here are 4 important ways to do it –

1. *Maintain a complete assortment of good tools for your work.*
2. *Use the right tool for the right job.*
3. *Use your tools properly.*
4. *Keep them in good condition – put them away safely and carefully.*

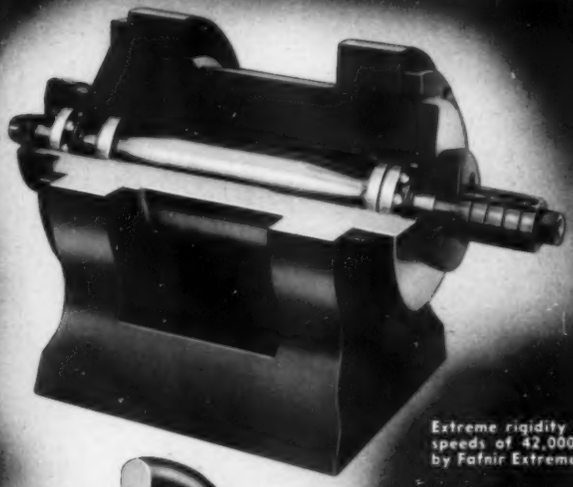
Saving just one of your tools from damage or loss will help give your soldier-partner a better rifle – a sharper bayonet when he needs it most. Plomb Tool Company, Los Angeles, California.

PLOMB Streamlined Tools

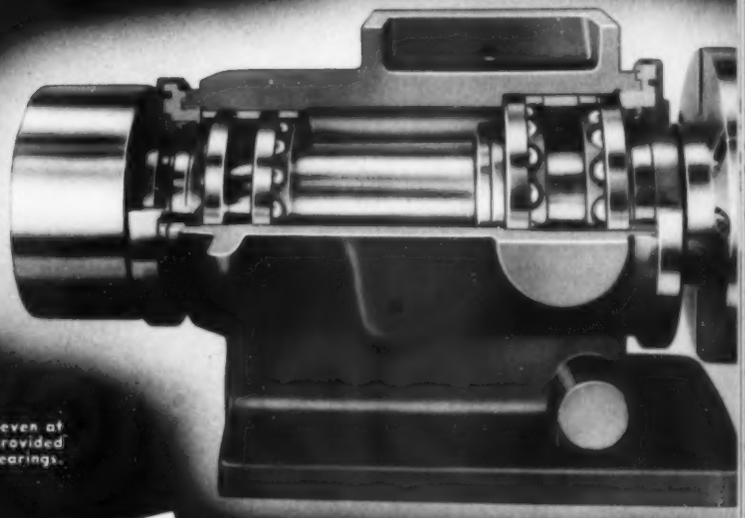
Tolerances limited to FIVE-MILLIONTHS of an inch...

Super-Precision Bearings with balls matched to size within .000005" . . . with eccentricities of assembled bearings checked to five decimal places . . . rings so carefully heat-treated and seasoned they maintain accurate dimensions, indefinitely . . . these are several of the fine points of high precision and accuracy built into Fafnir Preloaded Pairs of X Type Extreme-Precision Ball Bearings.

But that's only part of the story. Fafnir utilizes the "eyes" and "hands" of electricity to "feel" hundred-thousandths as your fingers feel inches . . . *matching these pairs so carefully* that variations between the assembled bearings are reduced to millionths of an inch. Inbuilt preloading eliminates any need for take-up adjustment after the pairs are mounted. Your requirements may not demand such extreme precision but the skill and care which makes these bearings possible is reflected in the quality of all Fafnir Ball Bearings. The Fafnir Bearing Company, New Britain, Conn.



Extreme rigidity of spindle—even at speeds of 42,000 R.P.M.—provided by Fafnir Extreme-Precision Bearings.



Greater rigidity of Fafnirized spindle enabled substitution of single grinding operation for the rough and finish operations previously necessary.

Ball bearing spindle design has shown better than 3 to 1 life advantage over previous plain bearings.

EVEN 900% IS NOT ENOUGH!

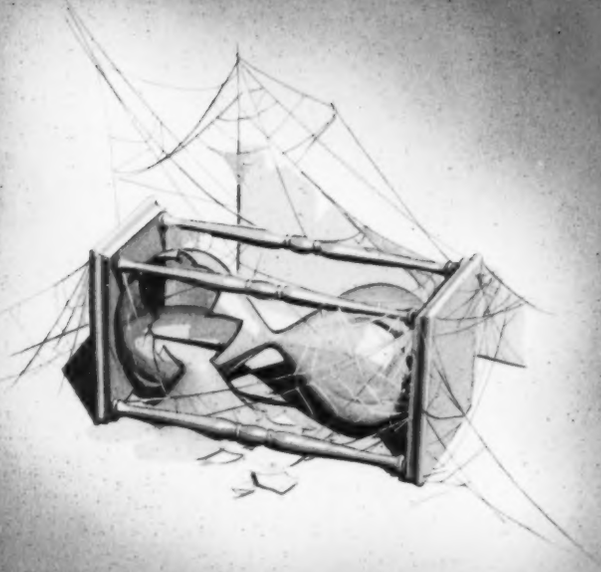
In the short period of four years we have increased production over 900% to meet the unprecedented requirements of war production. Even so, the demands for ball bearings for mechanized equipment have exceeded our production. If we are not able to fill your orders as promptly as you would like, you will understand why. We're doing everything possible to supply the bearings you need.

FAFNIR

Ball Bearings

THE BALANCED LINE
FOR ORDNANCE, AIRCRAFT AND
INDUSTRIAL MACHINERY

The BIG BOYS you tuck away and safely forget...



Some ball bearings are destined to live alone. Buried in an almost inaccessible gear box or housing they must perform under severest operating conditions for the life of the equipment. Their failure means a major "tearing-down" job. That's why you need a quality standard which allows the bearings to be safely tucked away and forgotten.

This quality is to be found in Fafnir Ball Bearings with their unequalled load capacity and ability to stand up under the most grueling treatment. These bearings incorporate the time-proved Fafnir Balanced Design – larger balls and deeper races for greater radial and thrust capacity. The Fafnir Bearing Company, New Britain, Conn.

Fafnir's large-ball, deep-groove design provides the user of heavy bearings with longer life, fewer breakdowns and better quality – all so vitally important today.

168 HOURS IS NOT ENOUGH

'Round-the-clock production 7 days a week still doesn't meet the demands for ball bearings for mechanized equipment and the machinery to make it. It has therefore been necessary to curtail the manufacture of several types and sizes of bearings. If you are not always able to get the type of bearing you have used previously we believe you will understand why.

FAFNIR
Ball Bearings

THE BALANCED LINE
FOR ORDNANCE, AIRCRAFT AND
INDUSTRIAL MACHINERY

Have you tried Scully?

WE are not magicians, but we will do everything within our power to help you get the materials you need. We have stocks of many steels on hand, also tools, machinery and other equipment.

Be sure to try Scully — see our phone numbers below. Cut out the number of the warehouse nearest you and paste it in a handy spot.

Structural material
Plates, various qualities
Floor Plates
Sheets: Hot Rolled, Cold Rolled, Galvanized, etc.
Bars (all shapes): Hot Rolled Carbon and Alloy grades
Hot Rolled Strip Steel
Spring Steel · Tool Steel
Drill Rod
Cold Finished Bars, Carbon and Alloy grades
Wire
COR-TEN and MAN-TEN Shapes, Sheets and Plates
Abrasion-Resisting Sheets and Plates
Eaves Trough, Conductor Pipe
U·S·S Stainless Steel and Stainless products
Expanded Metal
Rails
Boiler Tubes
Rivets, Bolts, Nuts, Washers
Dardelet Rivet and Machine Bolts
Nails
Welders and Welding Accessories
Chain
Clamps
Flanges
Expanders, etc.
Hoists, Shears, Rolls, Punches, Cut-Off Machines, Saws, Nibblers, etc.

CHICAGO	**BRUnswick 2000**
Teletype CG. 605	
BALTIMORE	**GILmore 3100**
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CLEVELAND	**HEnderson 5750**
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PITTSBURGH	**CEdar 7780**
Teletype PG. 475	
ST. LOUIS	**MAin 5235**
MINNEAPOLIS - ST. PAUL	**NEstor 2821**
NEWARK, N. J.	**BIgelow 3-5920**
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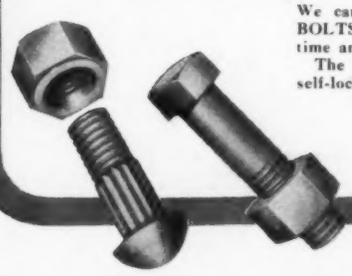
IN STOCK! DARDELET "RIVET-BOLTS"



We can offer immediate shipment of both Dardelet "RIVET-BOLTS" and Dardelet Machine Bolts. These bolts save valuable time and labor and assure permanently tight joints.

The Dardelet "RIVET-BOLT" is a ribbed bolt with Dardelet self-locking thread, and is widely used for field erection of structural steel. Has recessed nut. Bolt is driven in and nut is applied with a wrench. Economical and strong.

The Machine Bolt with Dardelet self-locking thread is for general use where vibration is present.

Scully Service

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Distributors of Steel and Steel Products

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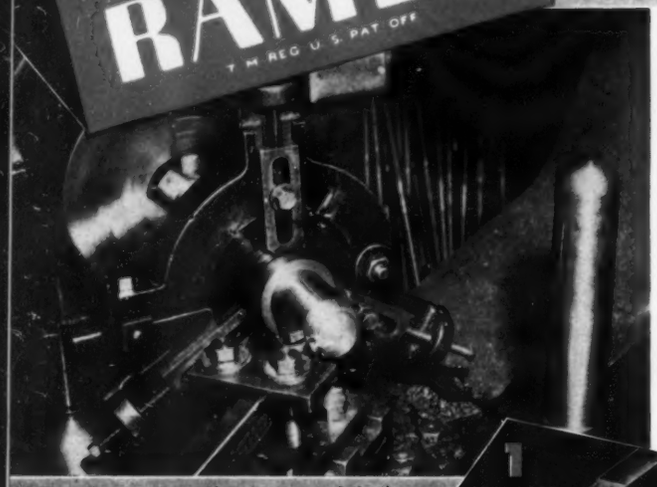
UNITED STATES STEEL

Maximum

WITH THE Vascoloy RAMET

T M REG U S PAT OFF

COMPLETE CONVERSION T



A small, general machine shop converts to the production of a variety of shell and gun parts using Method One.

5 METHODS

1 STANDARD TOOLS are complete tools, ready to use, in a choice of 10 styles, 3 grades, and many sizes — 164 tools in all. Ramet Carbide Tipped Standard Tools meet a majority of requirements for machining steel, cast iron, and all other materials, and are readily adaptable to special jobs.

Prompt delivery on Standard Vascoloy-Ramet Tools in reasonable quantity.

2 MILLED AND BRAZED TOOLS have a Ramet Carbide Blank brazed in place. All grinding is done by customer. Any size or shape of shank or grade of blank is obtainable in this classification.

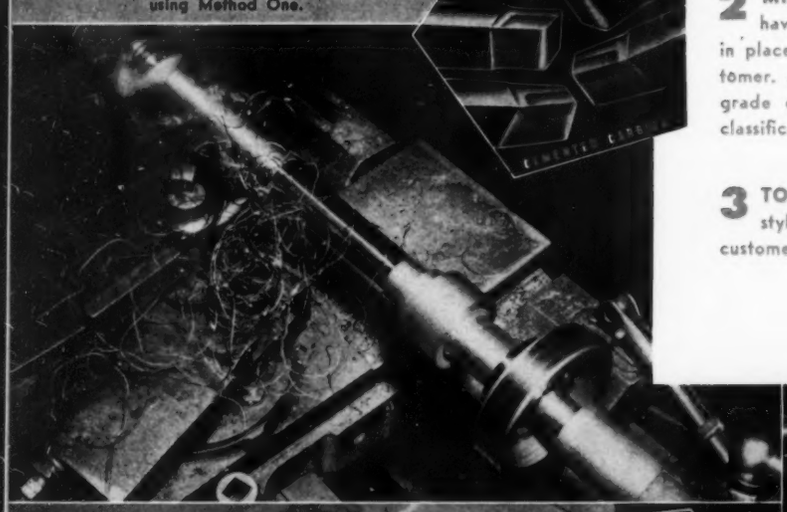
3 TOOLS TO ORDER cover any style or shape of tool made to customer's order. Ramet Cemented Carbide Blanks are brazed in position and tool finished ground ready to use.

4 BLANKS OF RAMET Cemented Carbide of any shape, grade, or style are obtainable for the customer to make his own tools. A large variety of sizes in two styles and any of the three general purpose grades are available as standard tools.

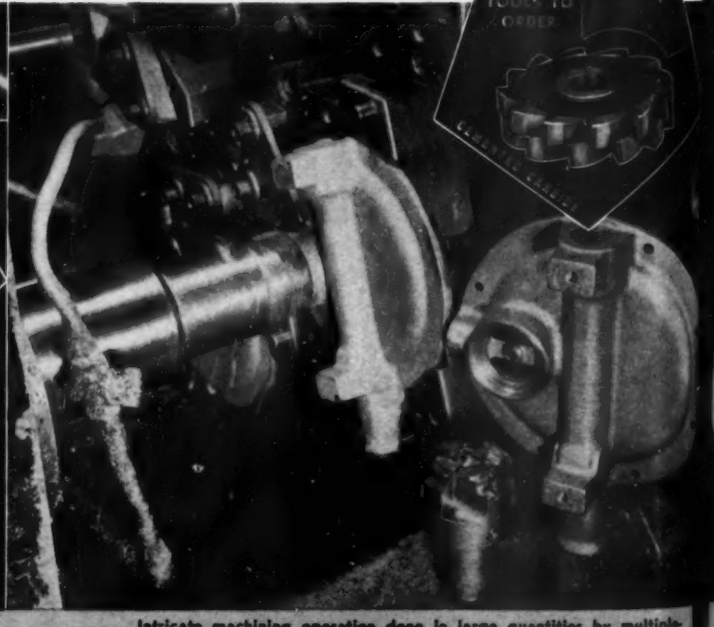
Prompt delivery on Standard Ramet Blanks in reasonable quantity.

5 TANTUNG "G" offers the ultimate in increased production where cemented carbides cannot be used. It is available as standard tools in a wide assortment of sizes and styles.

Prompt delivery on Standard Tantung "G" Tools in reasonable quantity.



By means of Method Two, this turret lathe is tooled for boring, facing, and turning in minimum time.



Intricate machining operation done in large quantities by multiple-step, carbide-tipped tool made to order. This illustrates an application of Method Three.

Production TOOL SERVICE

These typical applications of the five methods in the Vascoloy-Ramet Complete Tool Service illustrate how progressive shops are getting maximum production in converting from civilian work to the production of articles required in the war effort.

Whether yours is a jobbing shop, a small factory, or a large plant using cutting tools by the thousands, there is a method, or combination of methods, in the Vascoloy-Ramet Complete Tool Service that meets every requirement for maximum production tooling. For heavy hogging cuts, or accurate finish cuts, on cast iron, aluminum, bronze, or steel, Vascoloy-Ramet has the cutting tools for the job. The ever-increasing flood of orders from both large and small shops testifies to the wide acceptance of the Tantalum-Tungsten Carbide and the Tantung "G" Tools offered in this complete tool service.

In the furtherance of the armament program, it is up to you to get the most out of every machine you have. We can help you do it. Get full particulars on Tantalum-Tungsten Carbide and Tantung "G" Tools.

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

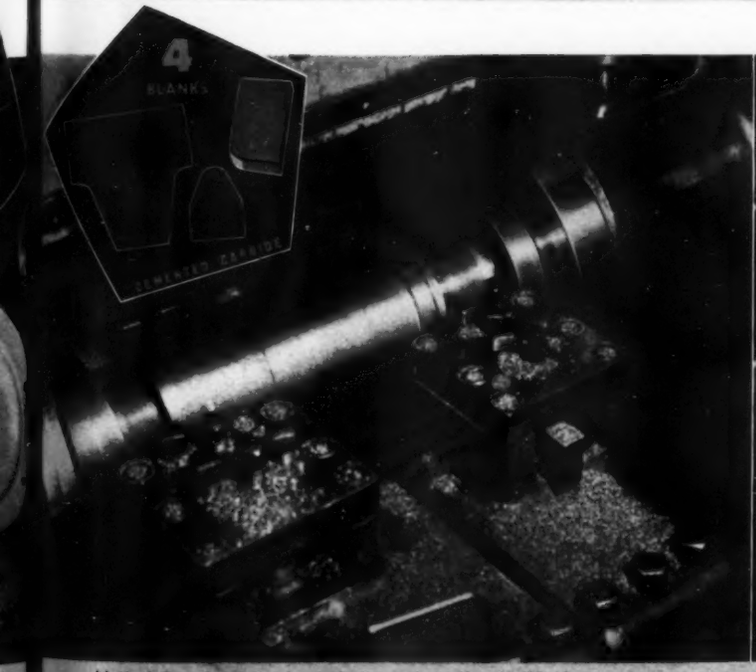
DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

TANTALUM-TUNGSTEN CARBIDE

FOR TOOL SERVICE... Specify Vascoloy RAMET TOOLS

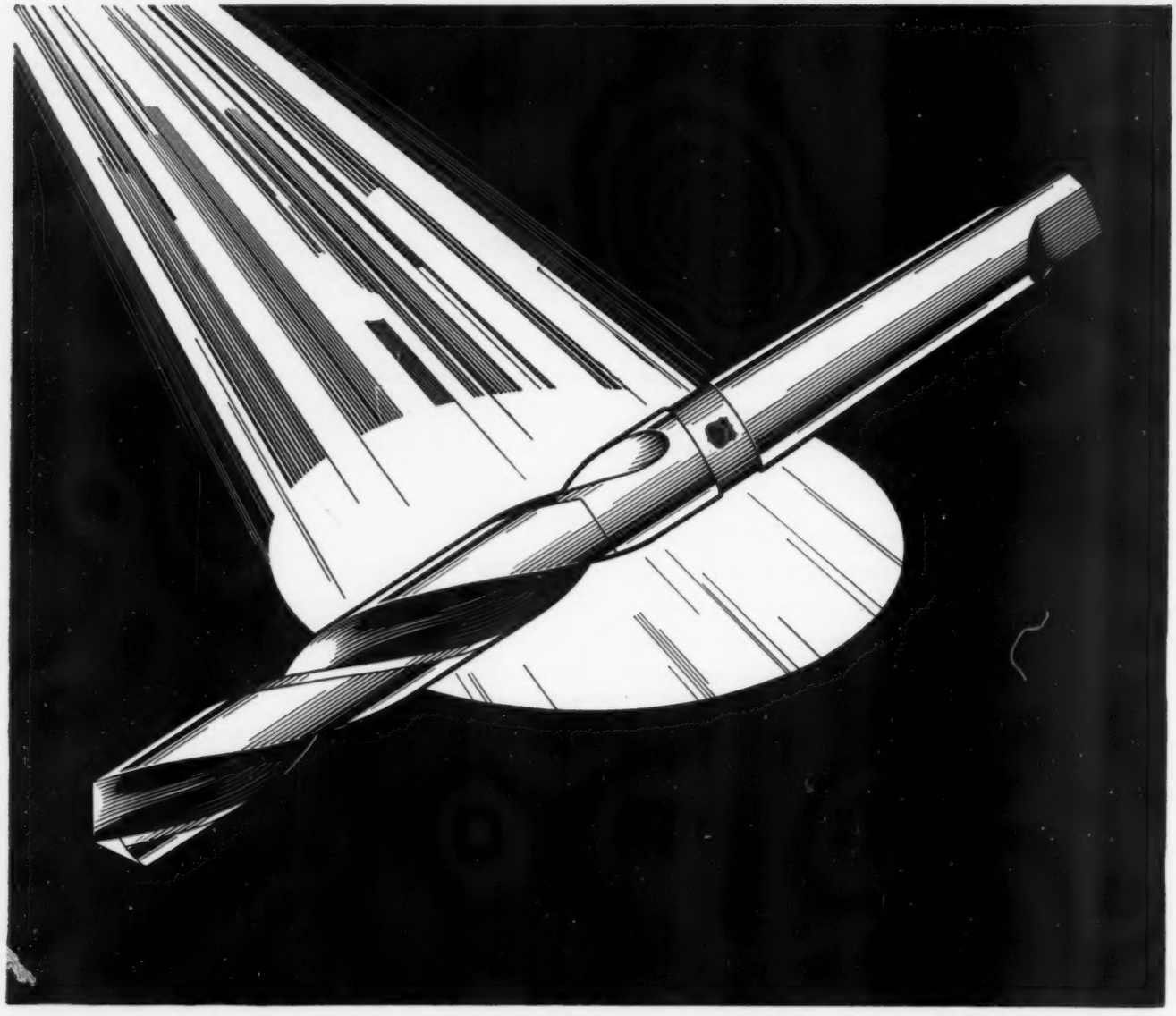
TANTUNG "G"



Method Four is used extensively for such tooling in this shop.

Tantung "G" Tools enable old machines in this shop to operate at capacity on subcontract pieces. Where cemented carbides can't be employed, use Method Five.

4244



Twist Drills · Milling Cutters
Taps · Dies · Reamers · Drill Chucks
Wheel Dressers · Special Tools

STANDARD TOOL CO.

THE STANDARD TOOL CO.

CLEVELAND

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THEY'RE ALL MO-MAX
"LMW" Alleghany Ludlum Steel Co.
"Mohican" Atlas Steels, Ltd.
"Bethlehem HM" Bethlehem Steel Company
"Mo-Cut" Braeburn Alloy Steel Corp.
"Star Max" Carpenter Steel Co.
"Molite 8" Columbia Tool Steel Company
"Rex-T-Mo" Crucible Steel Co. of America
"Di-Mol" Henry Disston & Sons, Inc.
"Rex-T-Mo" Halcomb Steel Co.
"Mogul" Jessop Steel Company
"Tatmo" Latrobe Electric Steel Co.
"S.T.M." Simonds Saw and Steel Co.
"Mo-Tung" Universal-Cyclops Steel Corp.
"Vul-Mo" Vulcan Crucible Steel Co.
Simultaneously drilling 28 holes in crank case of aircraft engine—a typical job for MO-MAX.
MO-MAX
MOLYBDENUM-TUNGSTEN HIGH SPEED STEEL
Thousands of tons of tools made of this steel with less than two percent of tungsten and no increase of vanadium, in nine years of widely varied service, have averaged 20 percent higher in efficiency than 18 percent tungsten steels.
For a flood of production with a trickle of tungsten, for conservation without deprivation, use MO-MAX. Your usual source of steel can supply you. For technical data booklet, write any of the mills named or The Cleveland Twist Drill Co., Cleveland, Ohio.

PERM-A-CLOR *Always First*

AMONG DEGREASING SOLVENTS

Stabilized chlorinated solvents for metal cleaning were originated by the Detroit Rex Products Company. Perm-A-Clor was introduced when it was first recognized that degreasing required the use of highly stabilized solvent. No other solvent has ever equaled it.

Perm-A-Clor is much more stable, both as a liquid and as a vapor, than ordinary solvents.

Triad, another Detrex solvent, is identical to Perm-A-Clor except in the kind and amount of stabilizer. War conditions create many new problems for all of us, but despite these obstacles, our chemical research is creating or finding new and even improved stabilizing materials, so that our products can be marketed without increase in price.

Select the one best suited to your needs.

Safe, Efficient, Low Cost Cleaning With Any Degreaser

CLEANING ENGINEERS DETREX DETROIT REX PRODUCTS

SOLVENT DEGREASING and ALKALI CLEANING

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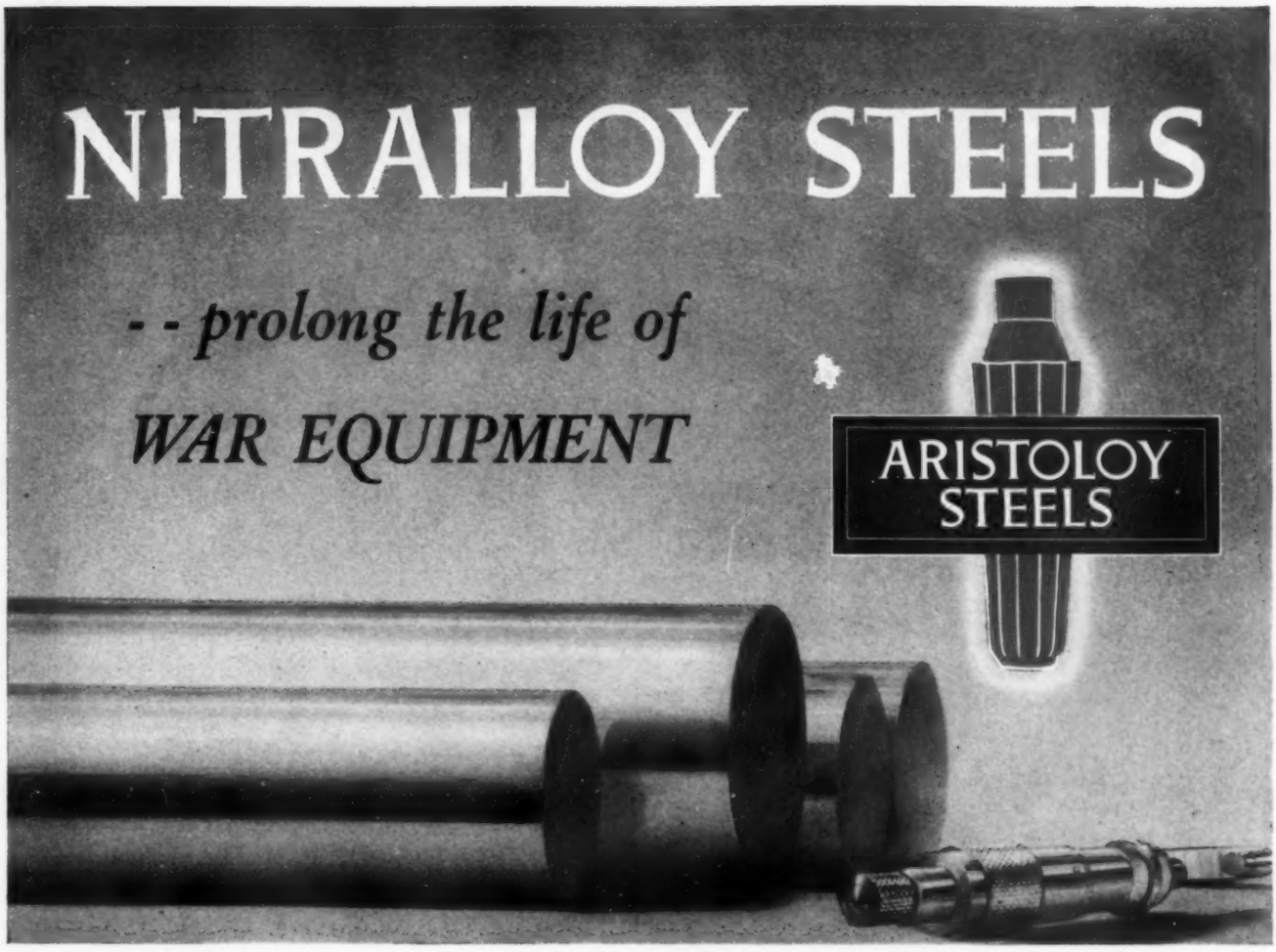
NITRALLOY STEELS

- - prolong the life of

WAR EQUIPMENT



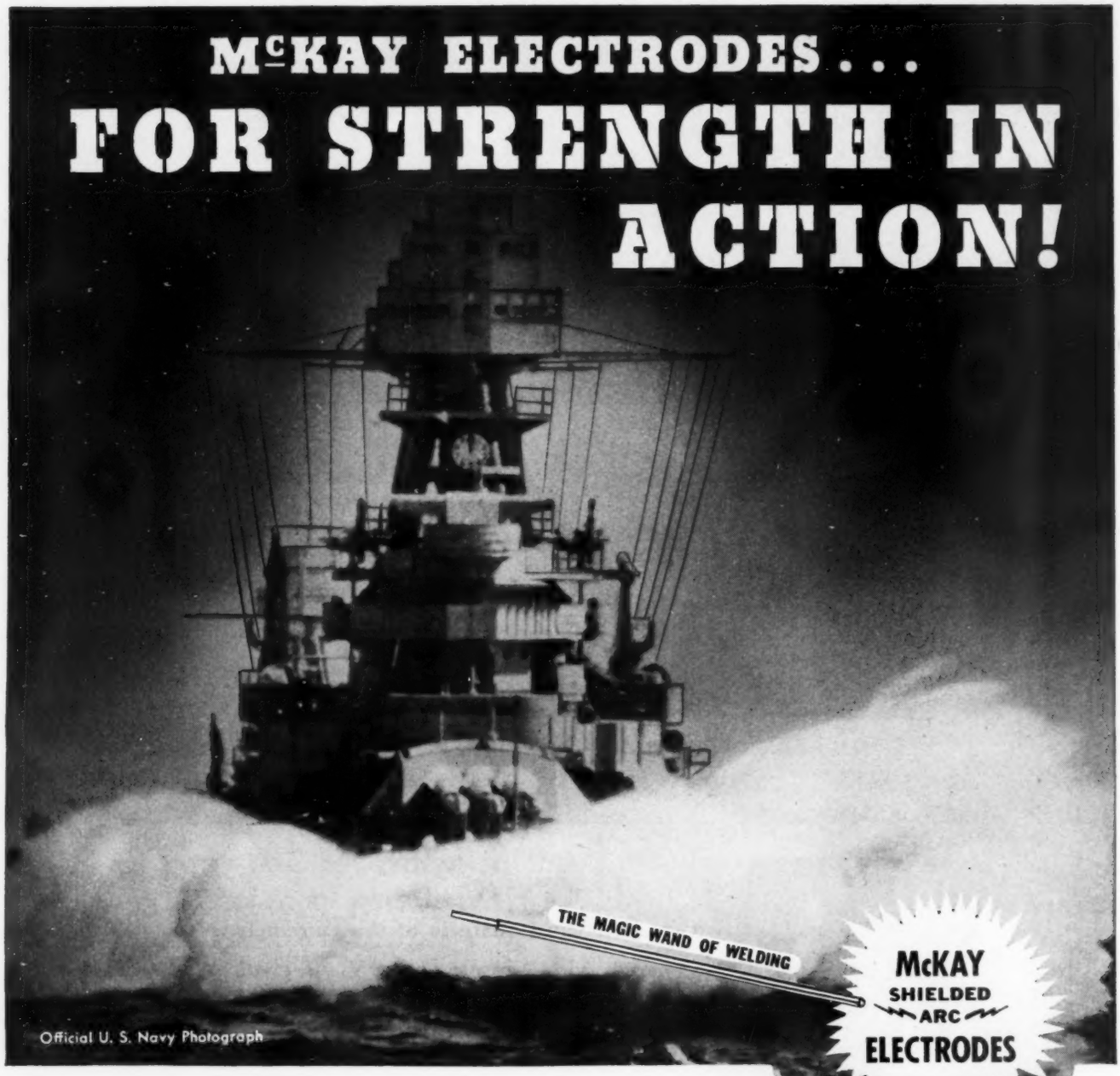
The well known wear-resisting qualities of the extremely hard surfaces obtainable with Nitralloy Steels have made Nitralloy essential for parts for tanks, planes, ships, guns and other war equipment. We are producing Nitralloy Steels hot rolled, annealed or heat-treated—turned or centerless ground.

COPPERWELD STEEL COMPANY WARREN, OHIO

ARISTOLOY STEELS

CARBON TOOL STEELS · ALLOY TOOL STEELS
AIRCRAFT QUALITY STEELS · STAINLESS STEELS
NITRALLOY STEELS · BEARING QUALITY STEELS

McKAY ELECTRODES...
FOR STRENGTH IN ACTION!



A ship of the line welded with McKAY Electrodes becomes an *integrated, seamless* hull of continuous steel, with no rivets to burst . . . harder to disable . . . a tough customer in battle!

As McKAY Electrodes SERVE in ship building they also SAVE! Save by materially reducing deadweight . . . save man-power . . . save ship ways by cutting building time in half . . . save millions of rivet holes . . . save vital steel!

The McKAY Company's greatly expanded capacity has been "enlisted for the duration" . . . to SERVE and SAVE wherever the superiority of its "researched" electrode line best functions in the nation's war effort.

THE McKAY COMPANY · PITTSBURGH, PA.

PACIFIC COAST SALES OFFICES: 125 S. Santa Fe Ave., Los Angeles · 100 Howard St., San Francisco

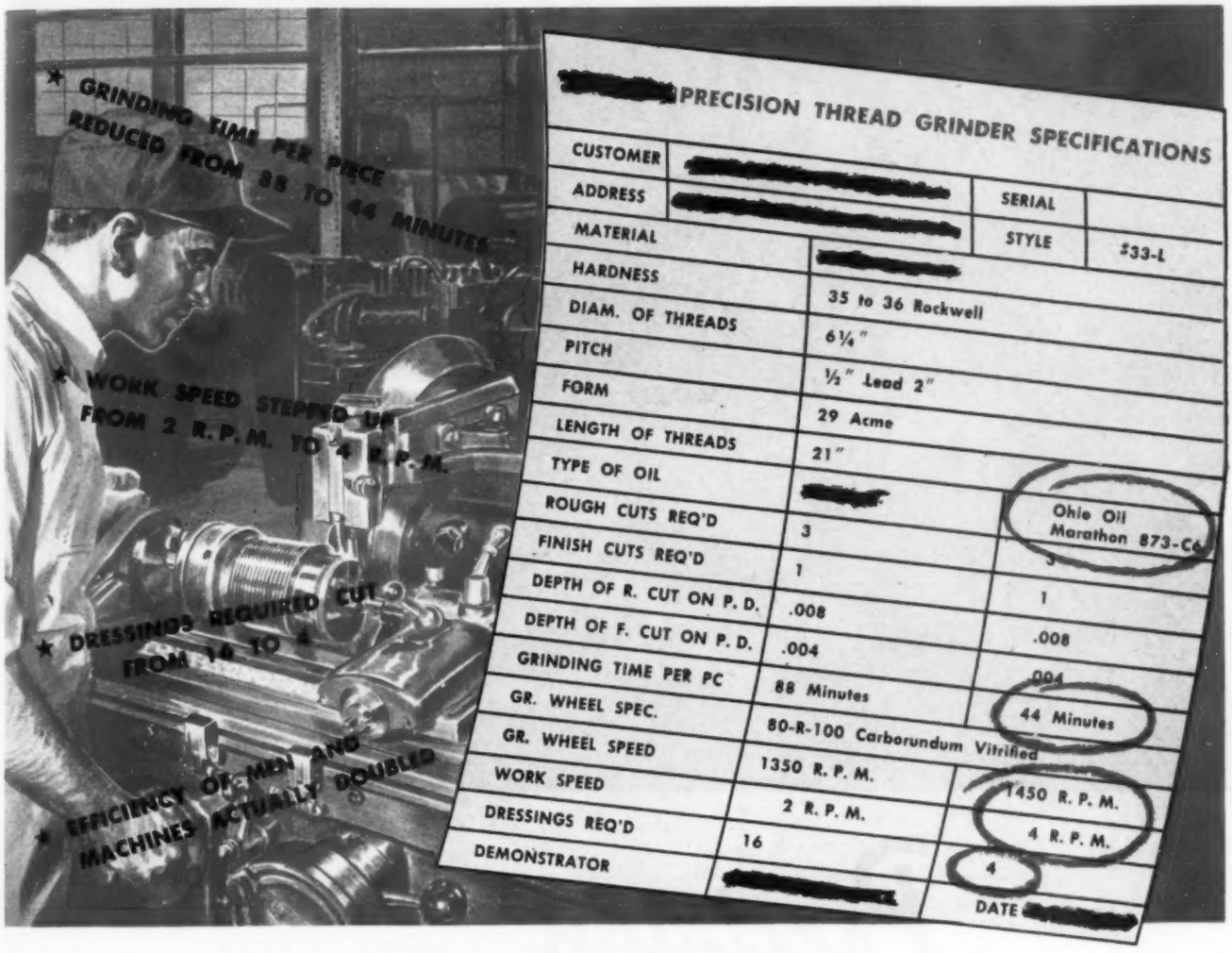
The McKay line includes regular carbon steel, stainless, and alloy steel electrodes for every welding purpose. Literature on request.

The McKay Company was among the first honored with the coveted Navy "E" award for excellence in fulfilling Naval Ordnance contracts.

McKAY WELDING ELECTRODES

AND INDUSTRIAL, MARINE AND AUTOMOTIVE CHAINS

Hitler and Hirohito are going to lose some sleep over this report


★ GRINDING TIME PER PIECE REDUCED FROM 88 TO 44 MINUTES
★ WORK SPEED STEPPED UP FROM 2 R.P.M. TO 4 R.P.M.
★ DRESSINGS REQUIRED CUT FROM 16 TO 4
★ EFFICIENCY OF MEN AND MACHINES ACTUALLY DOUBLED
[redacted] PRECISION THREAD GRINDER SPECIFICATIONS
CUSTOMER [redacted]
ADDRESS [redacted]
SERIAL
STYLE #33-L
MATERIAL [redacted]
HARDNESS 35 to 36 Rockwell
DIAM. OF THREADS 6¼"
PITCH ½" Lead 2"
FORM 29 Acme
LENGTH OF THREADS 21"
TYPE OF OIL [redacted] Ohio Oil Marathon 873-C6
ROUGH CUTS REQ'D 3
FINISH CUTS REQ'D 1
DEPTH OF R. CUT ON P. D. .008
DEPTH OF F. CUT ON P. D. .004
GRINDING TIME PER PC 88 Minutes 44 Minutes
GR. WHEEL SPEC. 80-R-100 Carborundum Vitrified
GR. WHEEL SPEED 1350 R. P. M. 1450 R. P. M.
WORK SPEED 2 R. P. M. 4 R. P. M.
DRESSINGS REQ'D 16 4
DEMONSTRATOR [redacted]
DATE [redacted]

Not a hope. Not a claim. New MARATHON C-6 cutting oil proves itself in actual test in leading airplane parts plant

Read that report . . . . then read it again. It's the actual report of a test made in one of America's largest, busiest airplane parts plants. It tells you better than we can how Marathon C-6 cutting oil can speed up production in *your* plant. C-6 is clean, transparent — operators can actually read a scale through it. Its lower working temperature means greater accuracy. Get the facts. Call in an Ohio Oil Company Lubrication Engineer to specify cutting and grinding oils that will boost production, save time, cut costs throughout your plant. Phone, write or wire, today.

A COMPLETE LINE OF CUTTING AND GRINDING OIL FOR EVERY REQUIREMENT

The OHIO OIL COMPANY, Inc.

GENERAL OFFICES: FINDLAY, OHIO

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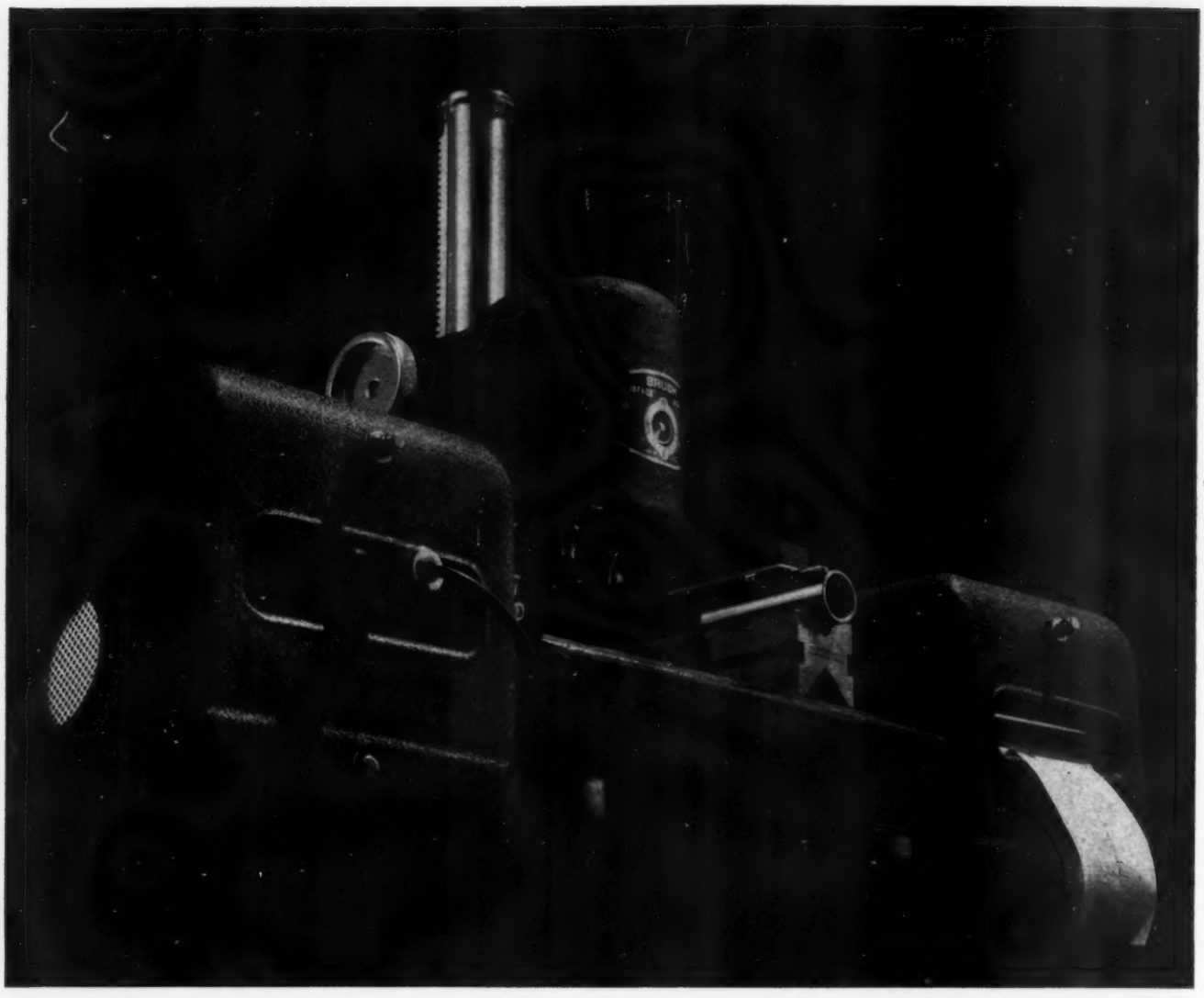
PRODUCERS OF PETROLEUM SINCE 1887



Precision STARTS WITH LITTLE THINGS • • • AS LITTLE AS .000001"

Surface smoothness (height, depth, pitch of each irregularity) is accurately measured to a millionth of an inch . . . precision at its finest . . . by the Brush Surface Analyzer.

The movement of the diamond stylus is amplified up to 100,000 times and immediately recorded on a moving paper chart for permanent reference.

Readily operated anywhere by plugging into a 110 volt, 60 cycle, A. C. line.

BRUSH CRYSTAL PRODUCTS

THE BRUSH DEVELOPMENT CO.

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Out of this brief case come successful methods for SPEEDING PRODUCTION of war supplies!

Out of the wide experience of Oakite Service Men . . . out of the brief case they carry . . . come performance-proved ideas, methods and short-cuts that are successfully helping thousands of plants to keep war production lines moving AHEAD OF SCHEDULE!

This Advisory and Engineering Service Free to ANY Plant

Listed in the panel at right are just a few typical examples of essential war supplies on which degreasing or cleaning and other closely related operations are a highly important factor in the production cycle.

To ANY plant converting to or now engaged in war work, Oakite Advisory and Engineering Service is freely available on these operations to help you fulfill the specifications and delivery requirements called for by your contract. Add this helpful service, experience and "know how" to your staff . . . use them ALL to help make every machine tool, every piece of equipment, every operation MORE PRODUCTIVE! There is no cost, no obligation. Inquiries answered promptly . . . write today!

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Representatives in All Principal Cities of the U. S. and Canada

CONVERTING TO WAR WORK?

Check this list of essential war supply items. If you now make or plan to manufacture any of these or other ordnance materiel, let us help you.

AIRPLANES
AIRPLANE MOTORS
FLIGHT INSTRUMENTS
AIRPLANE PARTS PROPELLER HUBS
BOMB FIN ASSEMBLIES
BOOSTER CAPS
FUZES & FUZE PARTS POWDER BOXES
CARTRIDGE CASES
SHELLS SHELL CASES
FLARE BOMB CASES
DEMOLITION BOMBS
INCENDIARY BOMBS
PRACTICE BOMBS GRENADES
LAND MINES
FIRE-CONTROL INSTRUMENTS
RANGE FINDER PARTS
COMMUNICATION EQUIPMENT
RADIO CHASSIS RIFLES
SMALL ARMS AMMUNITION
GUN BARRELS & PARTS
MACHINE GUN MOUNTS
ANTI-AIRCRAFT GUNS
BREECH RINGS BREECH LOCKS
TRENCH MORTARS HOWITZERS
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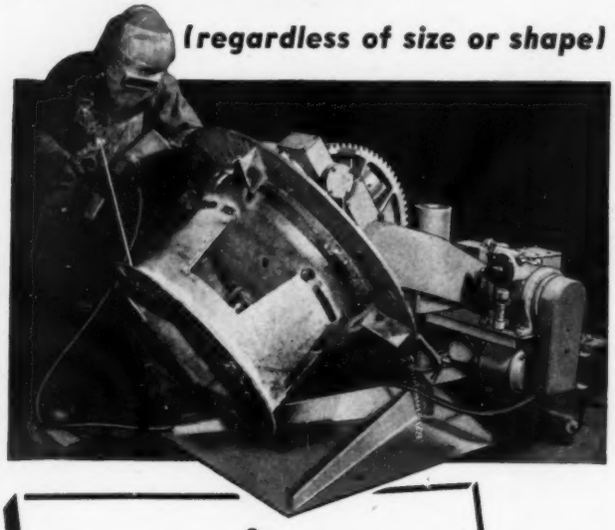
ETC.

OAKITE Specialized **CLEANING**

MATERIALS...METHODS...SERVICE — FOR EVERY CLEANING REQUIREMENT

ALL DOWN-HAND WELDING WITH JUST ONE SET-UP

(regardless of size or shape)



•

Faster, safer, better, "production-line" welding is accomplished on C-F Positioners.

•

This welder with control switch in one hand and rod in the other is laying a fillet under variable speed rotation (in a complete circle) with the weldment tilted at 135° (beyond horizontal). This means down-hand welding at every weld without changing the set-up on the machine.

•

C-F Positioners are made in the following sizes:

No. 12	Capacity	1200 lbs.
No. 25	Capacity	2500 lbs.
No. 60	Capacity	6000 lbs.
No. 140	Capacity	14000 lbs.

C-F Positioners feature:

Table rotation (360°) regardless of tilt.

Table tilts 135° (from horizontal)

According to model, C-F Positioners may be had in hand operated, hand and power operated or all power operated with variable or constant speed rotation. All machines furnished with portable base or for column-in-floor installation. Tables are removable for fixtures or jigs.

•

Our new circular WP 21 gives full information

CULLEN-FRIESTEDT CO.,
1313 S. KILBOURN AVE. CHICAGO, ILLINOIS

CONSERVE CUTTING ★ OIL ★

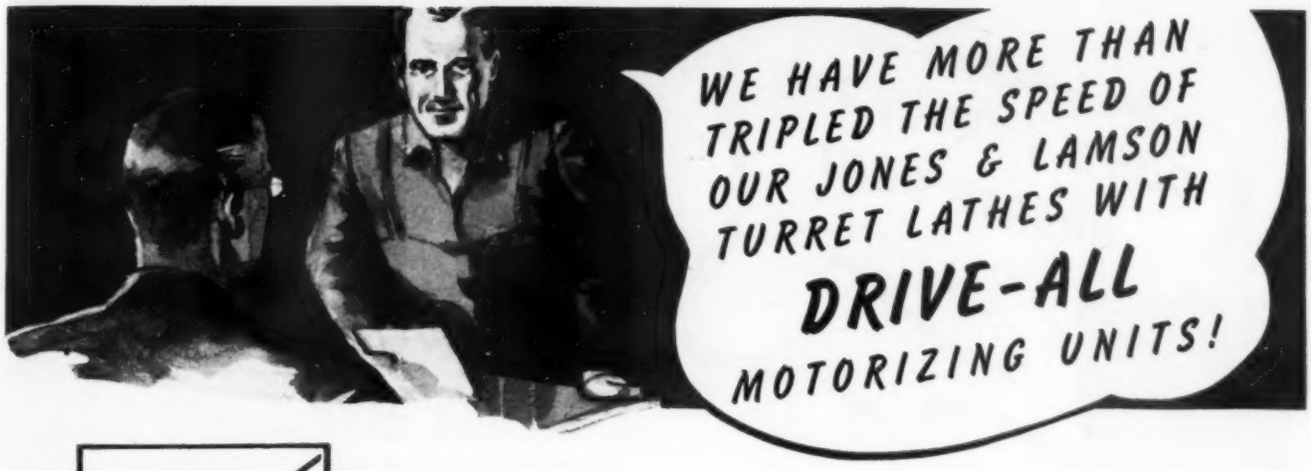
RECLAIM UP TO 98.6% OF YOUR CUTTING OIL

Tolhurst Chip Wringers recover as much as 98.6% of oil from chips through the application of centrifugal force. No steam is used, thereby eliminating any loss of oil through emulsification. Unskilled help can operate Tolhurst Chip Wringers efficiently.

REDUCE TOOL WEAR — Tool room records show reductions in tool wear of as much as 50% after installing Tolhurst equipment. The plentiful supply of reclaimed oil results in a more generous and conscientious use of cutting oil. Tools require less attention. Production goes on uninterrupted. Accuracy is maintained. If your machine tools are used in vital war production, investigate Tolhurst Chip Wringers for conserving cutting oil — reducing tool wear. *Write or wire for FREE bulletin.*

TOLHURST
CHIP WRINGERS

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

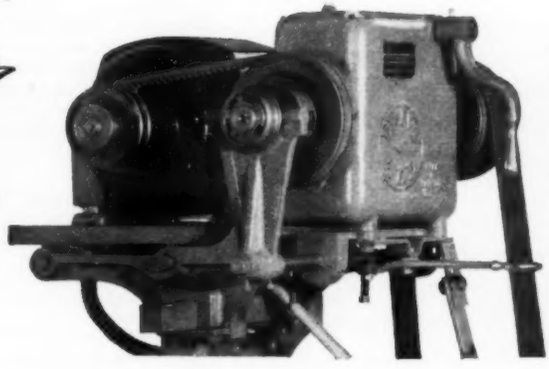


HERE'S THE CASE HISTORY

"Jones & Lamson turret lathes which previously operated at 360 R.P.M. with seven speed changes now are running at 1200 R.P.M. with the original seven speed changes in the lathe multiplied by the four in the DRIVE-ALL Unit giving us a speed range of 1200 R.P.M. divided into 28 separate changes, a very flexible arrangement."

(Letter in our files).

HERE'S THE DRIVE-ALL UNIT...



A selective speed motorizing unit that can be installed in approximately 2 hours. Available as Standard Unit, 1 to 5 h.p. and as Heavy Duty 5 to 10 h.p. Both with 3- or 4-speed gear boxes. The Drive-All installation cost in the above typical case totalled about $185, including all necessary electrical equipment. Drive-All prices begin well below this, depending on application.

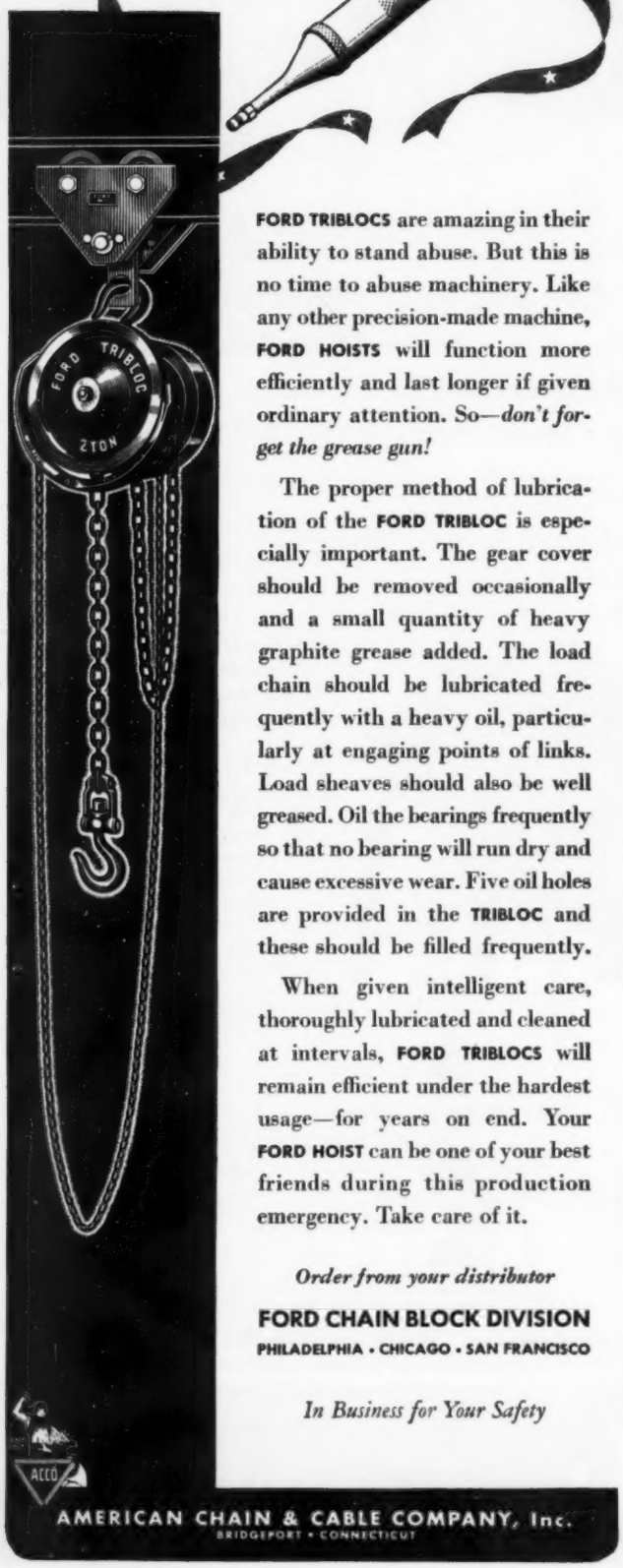
CHECK THESE DRIVE-ALL APPLICATIONS

- ☐ LATHES AND TURRET LATHES
- ☐ MILLING MACHINES
- ☐ GEAR CUTTERS
- ☐ DRILL PRESSES AND RADIALS
- ☐ AUTOMATICS
- ☐ SHAPERS AND PLANERS
- ☐ TAPPERS
- ☐ BORING MILLS
- ☐ SPECIAL APPLICATIONS

This may be just the solution to your production problems, too. Write for Drive-All Bulletin and address of your local representative. We will gladly study your requirements without obligation.

DRIVE-ALL MANUFACTURING COMPANY

DON'T FORGET THE GREASE GUN!



FORD TRIBLOCS are amazing in their ability to stand abuse. But this is no time to abuse machinery. Like any other precision-made machine, **FORD HOISTS** will function more efficiently and last longer if given ordinary attention. So—*don't forget the grease gun!*

The proper method of lubrication of the **FORD TRIBLOC** is especially important. The gear cover should be removed occasionally and a small quantity of heavy graphite grease added. The load chain should be lubricated frequently with a heavy oil, particularly at engaging points of links. Load sheaves should also be well greased. Oil the bearings frequently so that no bearing will run dry and cause excessive wear. Five oil holes are provided in the **TRIBLOC** and these should be filled frequently.

When given intelligent care, thoroughly lubricated and cleaned at intervals, **FORD TRIBLOCS** will remain efficient under the hardest usage—for years on end. Your **FORD HOIST** can be one of your best friends during this production emergency. Take care of it.

Order from your distributor

FORD CHAIN BLOCK DIVISION

PHILADELPHIA • CHICAGO • SAN FRANCISCO

In Business for Your Safety

ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

Showing foremen how to

—get and keep the confidence of his men
—get the day's work out on time
—maintain quality standards
—keep his costs down
—improve his methods

Suppose you are concerned about lining up your wage rates? or working out a training program? or suppose you think you may not have done such a good job handling somebody's grievance? Turn to the topic in this book and see how many ideas you can get. For this is a book of concrete ideas and suggestions. Here are practical things you can put to work today, tomorrow, and next week. This book has been written with only one purpose: to help you do the most effective job as a foreman.

Just Published

FOREMANSHIP FUNDAMENTALS

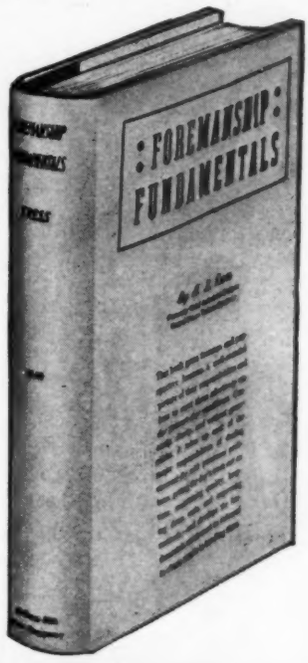
BY A. L. KRESS

Formerly Chief Industrial Engineer, U. S. Rubber Company.

276 pages, 5½x8, $2.50

This book gives you practical, workable, tested techniques for handling specific situations. It shows you just how other foremen are meeting their responsibilities effectively under present-day conditions.

Here is a book that you will want to know, to page through, to read, to keep handy for consultation. The coupon below, properly filled in and mailed, will bring you a copy for 10 days' examination on approval.



Read these Chapter Headings

1. What Men Respond To
2. The Right Man on the Right Job
3. Training
4. Safety and Accident Prevention
5. Wages and Rates
6. Handling Grievances
7. Collective Bargaining
8. The Factory Organization
9. Planning Production Schedules
10. Getting the Most out of Your Day
11. The Control of Quality
12. Keeping Costs Down
13. Improving Methods
14. It Is Up to You Now

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Send me for 10 days examination, subject to approval or return, Kress—Foremanship Fundamentals. At the end of 10 days I agree to pay $2.50, plus a few cents for postage and delivery, or return the book postpaid. (We pay postage on orders accompanied by remittance.)

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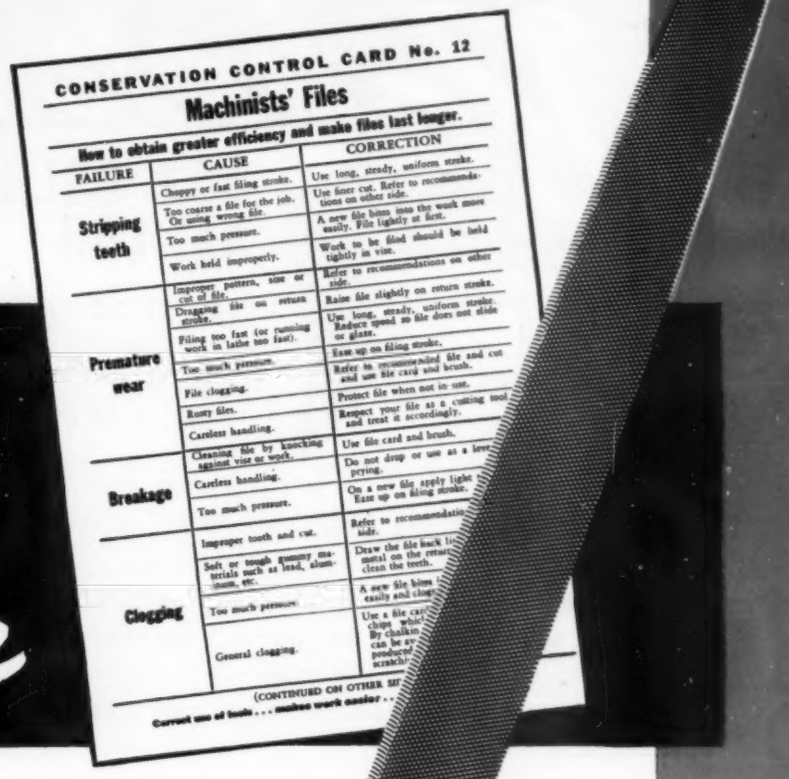
Company .....A. 6-11-42

The DISSTON CONSERVATION CONTROL PLAN will help you

Save more and Serve better


CONSERVATION CONTROL CARD No. 12

Machinists' Files

How to obtain greater efficiency and make files last longer.

FAILURE	CAUSE	CORRECTION
Stripping teeth	Choppy or fast filing stroke.	Use long, steady, uniform stroke.
	Too coarse a file for the job. Or using wrong file.	Use finer cut. Refer to recommendations on other side.
	Too much pressure.	A new file bites into the work more easily. File lightly at first.
	Work held improperly.	Work to be filed should be held tightly in vise.
Premature wear	Improper pattern, size or cut of file.	Refer to recommendations on other side.
	Dragging file on return stroke.	Raise file slightly on return stroke.
	Filing too fast (or running work in lathe too fast).	Use long, steady, uniform stroke. Reduce speed as file does not slide or glaze.
	Too much pressure.	Ease up on filing stroke.
	File clogging.	Refer to recommended file and cut and use file card and brush.
	Rusty files.	Protect file when not in use.
	Careless handling.	Respect your file as a cutting tool and treat it accordingly.
Breakage	Cleaning file by knocking against vise or work.	Use file card and brush.
	Careless handling.	Do not drop or use as a lever, prying.
	Too much pressure.	On a new file apply light Ease up on filing stroke.
Clogging	Improper tooth and cut.	Refer to recommendatio side.
	Soft or tough gummy materials such as lead, aluminum, etc.	Draw the file back l metal on the retur clean the teeth.
	Too much pressure.	A new file bites easily and clog
	General clogging.	Use a file ca chalk which By chalkin can be s produce scratchi

(CONTINUED ON OTHER SI

Current use of tools . . . makes work easier . .

In production for war, the more you save the more you can supply. The conservation of tools, time and materials was never so vital!

The Disston Conservation Control Plan is a nationwide program to help manufacturers reach and maintain maximum production . . . by making better use of equipment . . . by extending the useful life of tools . . . by saving time and essential materials.

Disston Conservation Control Instruction Cards are an important feature of this Plan. There are 34 in all, each applying to a different type of cutting tool. The cards contain expert information and practical instructions to help you prevent delays and waste . . . to simplify supervision . . . and to speed production by the proper selection, operation and maintenance of tools. You can use these cards to make tools last longer, to improve workmanship and product and to forestall failures and shutdowns.

Hundreds of important manufacturers are now applying these cards in a wide variety of operations. Disston Conservation Control Cards are available to *you* without cost or obligation, whether or not you use Disston products. Send now for the type and quantity you require.

Disston Bite-Rite Files

In all double cut Bite-Rite File patterns the teeth are staggered. This produces a file which successfully combines speed of cut, long life and smoothness of filed surface.

●

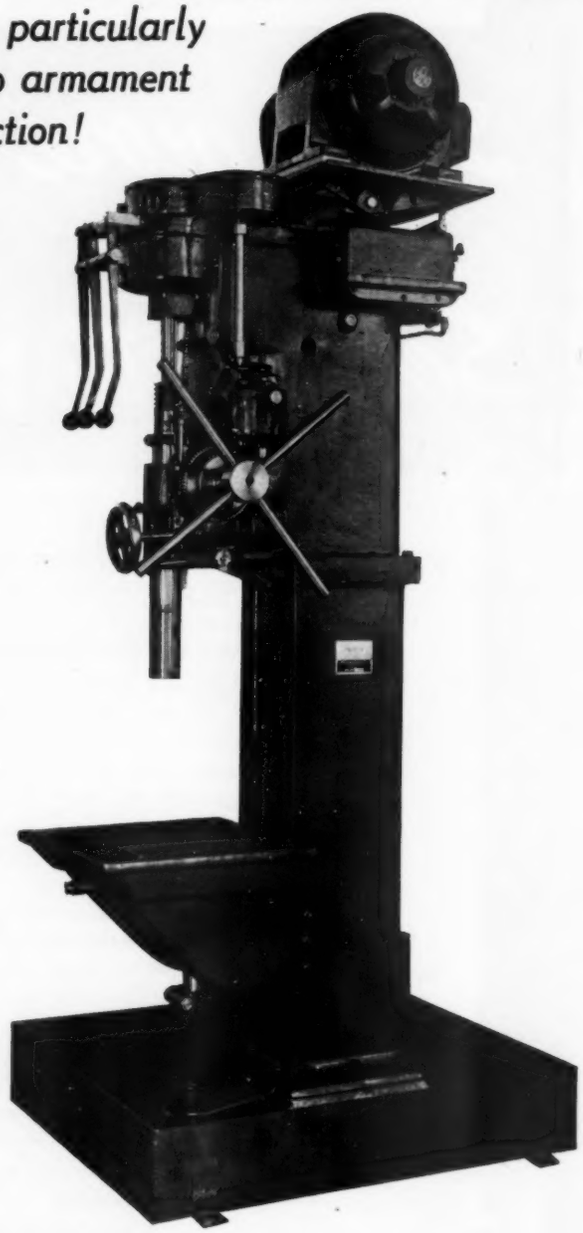
Get this Free Booklet

Here is complete information on the Disston Conservation Control Plan, reproductions of the Instruction Cards, and an order blank for your convenience. Write for this booklet today!

Waste has no place in industry today! A free booklet tells you all about the Disston Conservation Control Plan to save time, tools and materials. Write for it today to Henry Disston & Sons, Inc., 620 Tacony, Philadelphia, Pa., U. S. A.

Baker Drills

BOX COLUMN, HEAVY DUTY TYPE No. 150 . . . *Featuring wide feed and speed ranges particularly adaptable to armament production!*



BAKER has designed and built a new unit . . . the Model No. 150 Heavy Duty Drilling Machine . . . to replace the highly satisfactory Model No. 121. Although the general specifications of the new unit are similar to the old, the added features of wider speed and feed ranges make it a more useful machine under every operating condition.

Of particular value is the No. 150's speed range. There are 12 instantaneous quick changes of speed available, in a range of 48 to 1120 R.P.M. In addition, the unit is furnished standard with one set of pick-off gears, which doubles the range of available speeds to 24, with 82 to 1120 R.P.M. Other features include multi-Vee-Belt drive, multi-splined spindle drive, two piece frame design, and many other characteristics of accepted BAKER Drilling Machine superiority.

This flexible unit represents a source of both satisfactory drilling economies and high output for vital armament production, as well as general purpose operations. Capacity—1½" diameter drills in solid steel.

. . . WRITE FOR NEW CIRCULAR AND ENGINEERING DATA SHEET ON THIS OUTSTANDING NEW DRILL MACHINE

Our motto since 1867 — **"MACHINES: STURDY AND EFFICIENT, AS FINE AS CAN BE BUILT"**

BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

DRILLING • BORING • TAPPING • AND • KEYSEATING MACHINES

FREE INFORMATION FOR YOUR METAL-WORKING LIBRARY

New Catalogs, Booklets, Bulletins

METAL-WORKING EQUIPMENT

1 LATHES—Norwood Engineering Co., Florence, Mass. 6-page illustrated folder on hydromatic lathes for production machining described in detail. Also 4-page folder on Model ST-105-2 for machining 105 mm. shells, describes, illustrates rough-turn operations.

2 CYLINDRICAL SUPERFINISHING—International Machine Tool Corp., Foster Division, Elkhart, Ind. 140-page illustrated manual, describes superfinishing process, importance, results to be obtained, control selection of abrasives and a great deal more invaluable information.

3 GRINDERS—Cincinnati Grinders Inc., Cincinnati, O. 20-page illustrated catalog G490 describes with specifications 10-in. plain hydraulic, center-type grinding machines. 20-page G-491 covers 14-in. and 16-in. plain self-contained grinders.

4 CONTOUR SAWING MACHINES—Continental Machines, Inc., Minneapolis, Minn.—50-page "A Short Talk on 40 Different Ways to Cut Machining Costs" illustrates ways to save time and metal in DOALL machining practices. Diagrams on how to stack parts in making stampings without guides, welding sawbands, how to grind and readjust saw guide inserts, use of mirrors in filing operations, etc. Invaluable to all operators.

5 MACHINE TOOLS—Louis E. Emerman & Co., Chicago, Ill.—192-page Ready Reference Machinery Redbook lists and illustrates available line of machine tools of all types, giving specifications. Each different type clearly illustrated. Catalog of interest to all using metal-working machinery.

6 RADIAL DRILLING AND ROUTING—Onsrud Machine Works, Inc., Chicago, Ill.—53-page handy "Tricks and Tips on Radial Arm Drilling and Routing." Textbook on the subject, including essential facts of drill, template and router pattern construction, as well as machine maintenance. Of special use to aircraft manufacturers.

7 MACHINE TOOLS—Baker Bros., Inc., Toledo, O.—62-page illustrated catalog on complete line of drilling, boring, tapping, keyseating and contour grinding equipment. Full-page illustrations of machines with description and specifications.

8 LATHES—Bradford Machine Tool Co., Cincinnati, O. — 50-page illustrated catalog describes in detail construction features and types of Metal-Master lathes. Also available accessories with charts on recommended tests.

9 THREAD MILLERS—Waltham Machine Works, Waltham, Mass.—4 page folder illustrates machines and parts with data and specifications on use.

10 TOOL GRINDERS AND LATHES. —J. G. Blount Co., Everett, Mass. —Catalog A-8 gives details on wet and dry tool grinders, while Catalog D-18 illustrates and describes special application lathes for turning, buffing, polishing and lapping operations.

11 SHELL MACHINES—Hepburn American Co., Greenwich, Conn.—26-page illustrated catalog on single purpose machine tools for manufacture of 2-in. to 12-in. shells, describes construction and design of machines and advantages in detail. Gives charts showing machine number for various operations on shells.

For Your Convenience

Two business-reply cards are printed here. On each is room for you to request four pieces of literature.

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1. If you are requesting four pieces or less, please use only the bottom card. Likewise, for five to eight pieces, use both cards.

2. Be sure to fill one space for each piece you order. This will assure your receiving copies of literature promptly by reducing clerical work in handling your requests.

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12 INDEX MILLS—Blank and Buxton Machinery Co., Jackson, Mich. 8-page illustrated folder describes with specifications, line of index mills and close-ups of spindles in action. Also list of users.

13 DRILLING MACHINES—Pratt & Whitney, West Hartford, Conn. 4-page illustrated folder on Sigourney sensitive drilling machine gives advantages and specifications.

14 BORING, DRILLING AND MILLING MACHINES—Bausch Machine Tool Co., Springfield, Mass. Illustrated folder on hydraulic horizontal boring, drilling and milling machines, gives description and specifications with advantages of machine.

15 SHELL LATHES — Morey Machinery Co., New York, N. Y. 12-page illustrated folder on semi-automatic lathes for rough finish and turning shells from 105 mm. to 155 mm. Large illustrations describes operations. Machines with specifications and diagrams described.

16 STAMPING MACHINES—Chambersburg Engineering Co., Chambersburg, Pa. 34-page catalog 276 on Cecostampings—high production impact type stamping machines developed for aircraft work. Illustrations show machine and details of parts with samples of work produced in aircraft plants.

TOOLS AND ACCESSORIES

17 CARBIDE TOOLS — Firth-Sterling Steel Co., McKeesport, Pa. 12-page illustrated catalog on Firthite general purpose tools gives ten standard styles with sizes, prices and variations obtainable by simple grinding. Also 18-page catalog on "Speed War Production with Standard Firthite Sintered Carbide Tips." Includes new standard and non-standard tool tip sizes and price list.

18 STEEL STAMPS—Jas. H. Matthews & Co., Pittsburgh, Pa. 16-page catalog on stamping single and multiple characters with Matthews steel stamps and type holders gives data on relative factors of safe stamping, various types and sizes with prices. Equipment thoroughly illustrated and chart of steel stamps for symbol marking.

19 CUTTING OILS—Gulf Oil Corp., Pittsburgh, Pa. 32-page illustrated catalog on cutting oils for increased production and longer tool life, shows how machine tool productivity may be increased by proper application of cutting oils. Shows how cutting oils help improve machine practice and has technical data section covering machining of important materials. Valuable reference on machining of various materials.

20 FOLLOWER MACHINES—Turchan Follower Machine Co., Detroit, Mich. 12-page catalog on follower machine illustrates application on machine tools. Describes modernizing mills with them.

21 METAL CLEANING—Magnus Chemical Co., Garwood, N. J. 50-page catalog gives complete data on cleaning various munition items such as cartridge cases, steel shells, fuses and fuse parts, etc. Good reference.

22 GRINDING OILS—White & Bagley Co., Worcester, Mass.—30-page illustrated booklet on grinding oils and lubricants for precision grinding. Illustrations show applications in use and advantages obtainable through it. Excellent application photographs.

23 DUPLICATORS—Detroit Universal Duplicator Co., Detroit, Mich. Series of 6 illustrated data pages show uses these machines can be put to and savings and advantages obtainable.

24 GAGES—Dearborn Gage Co., Dearborn, Mich. 6-page illustrated folder on Ellstrom internal setting gage, emphasizes versatility and accurate readings.

25 PENETRATING OIL—Samuel Cabot, Inc., Boston, Mass. 4-page folder on Tasgon penetrating oil and rust loosener, Lubri-Tasgon, a penetrating lubricating oil, and Plasgon, a plastic gasket and joint cement. Gives complete data on uses and advantages.

26 METAL CUTTING SAWS—E. C. Atkins and Co., Indianapolis, Ind. 32-page illustrated booklet provides guide to metal-cutting efficiency, showing in detail curled-chip system and advantages of use, with diagrams and illustrations. Gives details on right blade for job, list of sizes, types and prices available. Engineering data included.

27 CARBIDE TOOLS—McKenna Metals Co., Latrobe, Pa. 48-page pocket manual on selecting, designing, using, brazing and grinding Kennametal tools. Designed to help user get utmost service from tools.

WELDING EQUIPMENT

28 ELECTRODES — Vascoloy-Ramet Corp., North Chicago, Ill. 4-page Bulletin W-42 on pure tungsten electrodes for atomic hydrogen welding, gives complete information including specifications on full range of sizes.

29 ELECTRODES—Lincoln Electric Co., Cleveland, O. 16-page folder, on "Fleet-Fillet" welding technique for speeding war production, has illustrations and diagrams describing advantages and illustrating it in use. Tables give invaluable engineering data.

PLANT SERVICE EQUIPMENT

30 CUTTING OIL SANITATION—C. B. Dolge Co., Westport, Conn. 20-page illustrated booklet shows damage bacteria in cutting oils do, how they get there, and how their disinfectant is tailormade for protecting workers.

31 PORTABLE BLOWERS — Breuer Electric Mfg. Co., Chicago, Ill. Folder describes and illustrates Tornado Model 10-A for solving most difficult cleaning problems. Powerful enough for chip removal, etc. Also folders on electric writing tool and air raid sirens.

32 AIR PAINTING SHELLS, ETC.—Paasche Air Brush Co., Chicago, Ill. 14-page illustrated folder describes and illustrates in detail with specifications automatic units and special equipment for airpainting shells, bombs, land mines, fuse parts and miscellaneous items.

33 INDUSTRIAL TRUCKS—Yard-Man, Inc., Jackson, Mich. 6-page folder gives data, illustrations and specifications on new industrial trucks. Shows its peculiar advantages and how it was developed through actual necessity.

PARTS AND MATERIALS

34 RUBBER PRODUCTS—U. S. Rubber Co., New York, N. Y. 48-page illustrated book on conservation of rubber products in industry. Invaluable reference, giving complete suggestions on proper care from initial design through inventory and storage to use, maintenance, inspection and repair. First aid to industry in conserving rubber, and includes all mechanical rubber goods. Everyone should have a copy.

35 VULCANIZED FIBRE—Continental Diamond Fibre Co., Del. 16-page illustrated catalog, DF-41 gives detail on standard grades, fabrication and machining in your own shop, with advantages of use. Engineering data on specific properties and useful data for figuring weights.

36 COLLOIDAL GRAPHITES—Acheson Colloids Corp., Port Huron, Mich. 4-page folder gives technical data on Colloidal Graphite Dispersions, discusses use as anti-friction body in machinery, lubricant in the drawing, forging, extruding of metals, conductor resistor body for electrical and electronic applications, etc.

FIRST CLASS
PERMIT No. 10
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NEW YORK, N.Y

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

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NEW YORK, N.Y

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A flexible machine that is the last word in simplicity of operation

HI-SPEED
HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"... Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2⅜"	2⅜"	2½"	2⅜"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia.	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44"x60"	60"x80"	60"x80"	60"x108"
Overall Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

Of various cartridge clips produced on Dieing Machines, this one is for caliber .303 rifle produced from flat material complete one per stroke at exceptionally high rate.

The Dieing Machine makes precision rifle clips COMPLETE PER STROKE

INCLUDING BROACHING

Airplane strut seat of .031" brass produced complete one per stroke at new high rate.

Airplane fuselage hinge of duralumin produced complete per stroke in continuous strip to precision limits including BROACHING operation.

Machine gun belt link produced complete one per stroke to extreme precision limits at exceptionally high speed.

Holding precision of stamped product within .0002" limits when required, the unique Dieing Machine makes precise munitions parts at new high rates. Production of one of these machines equals 5 to 10 conventional presses. 1 to 20 completed parts are produced per stroke, at speeds up to 600 s. p. m., including intricate pieces involving blanking, piercing, forming, drawing, coining, extruding and broaching. For today's requirements, it offers an unequalled combination of high production and high precision! Capacities: 10 tons to 300 tons.

– and scores of other Munitions Items!

STAMPINGS

- Mechanical time and contact fuse parts
- Rifle components
- Cartridge clips, or rifle chargers
- Gas Mask stampings
- Ammunition stampings
- Bomb components
- Shell parts
- Detonator stampings
- Airplane instrument engine and fuselage parts

OPERATIONS

- Bullet assembling
- Primer inserting
- Automatic time and contact fuse assemblies

Request catalog 42

THE HENRY & WRIGHT MFG. CO.

484 Windsor St. Hartford, Conn.

Henry & Wright Dieing Machines

All-Out WAR PRODUCTION NEEDS THIS PROTECTION . . .

Against DELAYS, SABOTAGE, FIRE, WATER and ACCIDENT HAZARDS

● Lyon Shop Equipment accelerates production by helping workers make efficient use of every machine, every square foot of floor space, and every minute. It guards against hazards that cause costly delays . . . and might necessitate complete shut-downs. Write for catalog.

LYON METAL PRODUCTS, INCORPORATED

General Offices:

7806 Madison Avenue, Aurora, Illinois

Branches and Distributors in All Principal Cities

LYON SHOP EQUIPMENT *Service*

You need this hammer!

Just loosen this nut, and the faces drop right out. You can replace with babbitt, copper or rawhide in a few seconds.

SAVES TIME

No time is lost when worn faces are to be replaced in the BASA Hammer. Replacements are made as easily and quickly as in a safety razor. The patented, fine-tool design of this hammer provides better balance, more effective blows, convenient adjustment of the faces, and longer life.

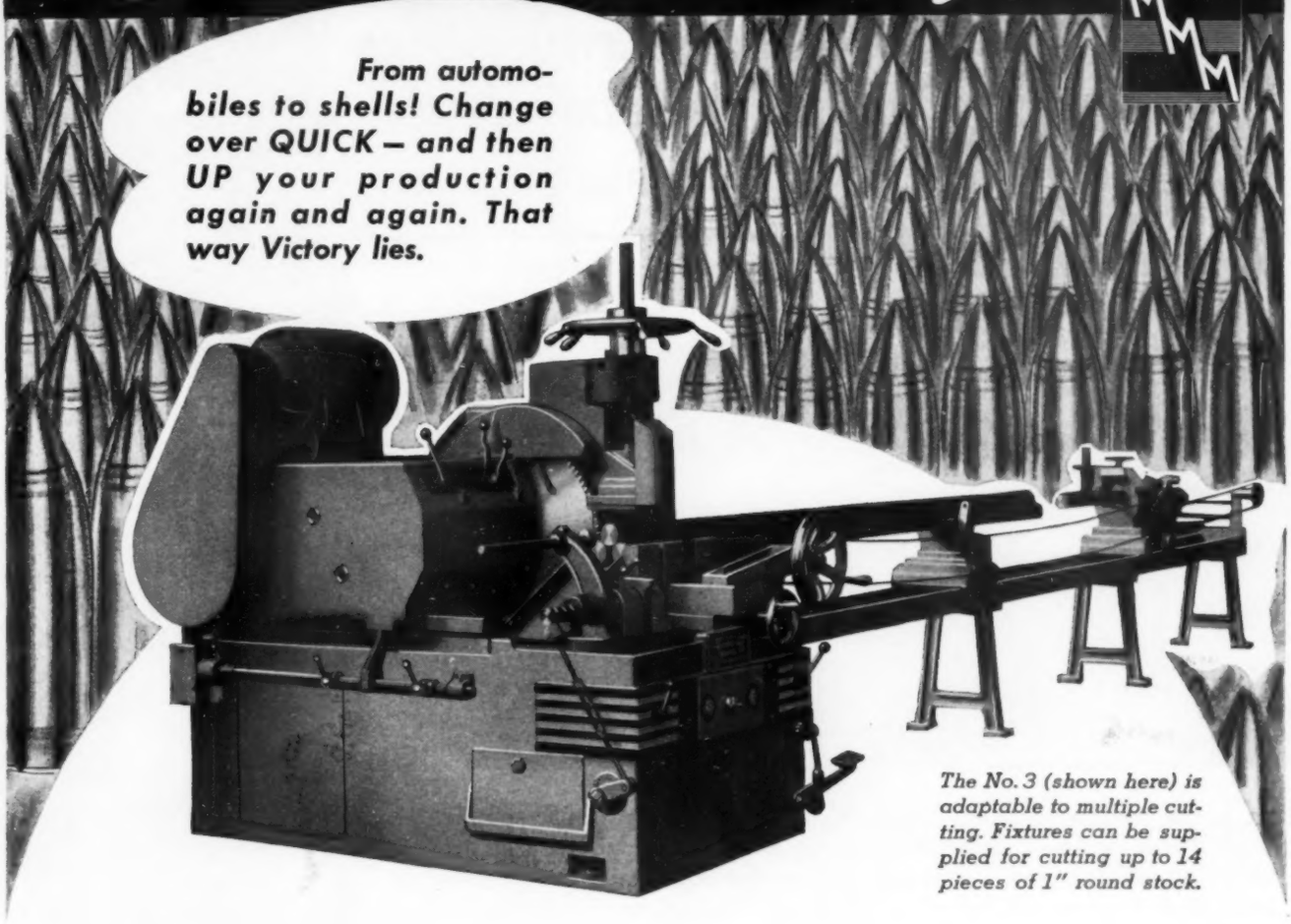
Made in five sizes, with cadmium-plated special alloy-steel heads, finest quality Java water buffalo rawhide faces. Carried by leading mill supply houses. Also EMPIRE* All-Rawhide Mallets for lighter work.

*REG. U. S. PAT. OFF.

GREENE, TWEED & CO., Bronx Blvd. at 238 St., New York, N.Y.

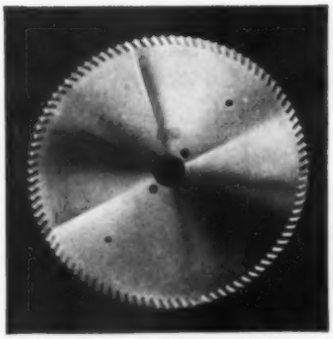
The BASA* Replaceable Face HAMMER

Over and Up!



The No. 3 (shown here) is adaptable to multiple cutting. Fixtures can be supplied for cutting up to 14 pieces of 1" round stock.

With the development of adequate equipment designed and refined expressly for the purpose, the cold sawing of metal figures more and more prominently in the lift that is being imparted to the nation's war effort. Motch & Merryweather Cold Sawing Machines have already cut many millions of shell slugs with uniform accuracy, with square ends, without burr or scrap, at new and tremendous top speeds. The installing of Motch & Merryweather Cold Saws has invariably brought about an exceedingly swift transition from peace-time to war-time production. Their ability to "take it" every hour in the week, month after month, has jumped the output of munitions in a degree impossible to estimate. Ask for our bulletin.



Motch & Merryweather Segmental Saw Blades have definitely set new standards of speed, precision and endurance.

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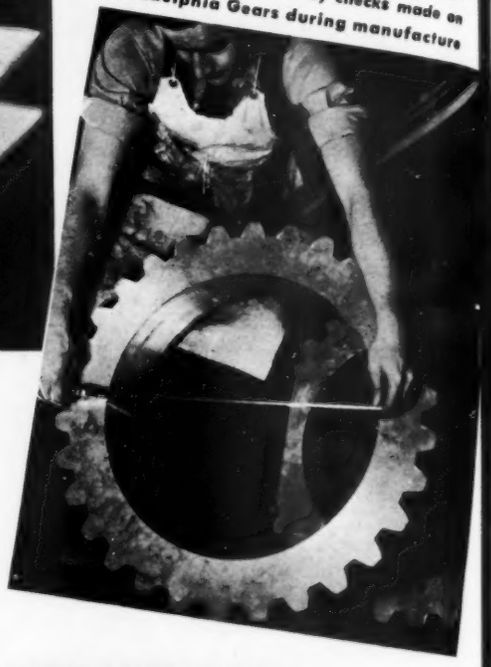

Therein is the reason so many industrial firms fill all their gear requirements at Philadelphia. Constant checking and rechecking assures the accuracy that makes smooth, efficient, trouble-free operation a certainty. This same care is given all Philadelphia gears. Regardless of the type or size of gear you need, do as thousands of other plants have been doing during the past 50 years . . . specify Philadelphia. Why not get our gear catalog for handy reference. A request on your company letterhead brings a copy.

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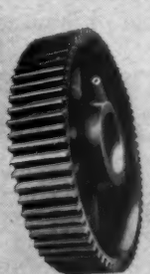

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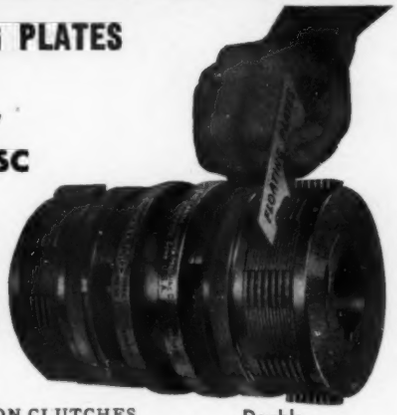

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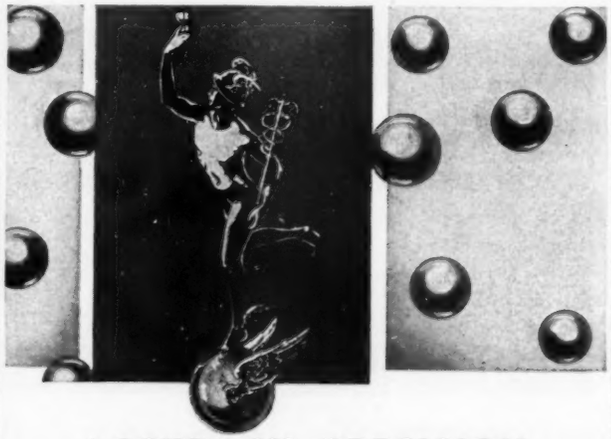

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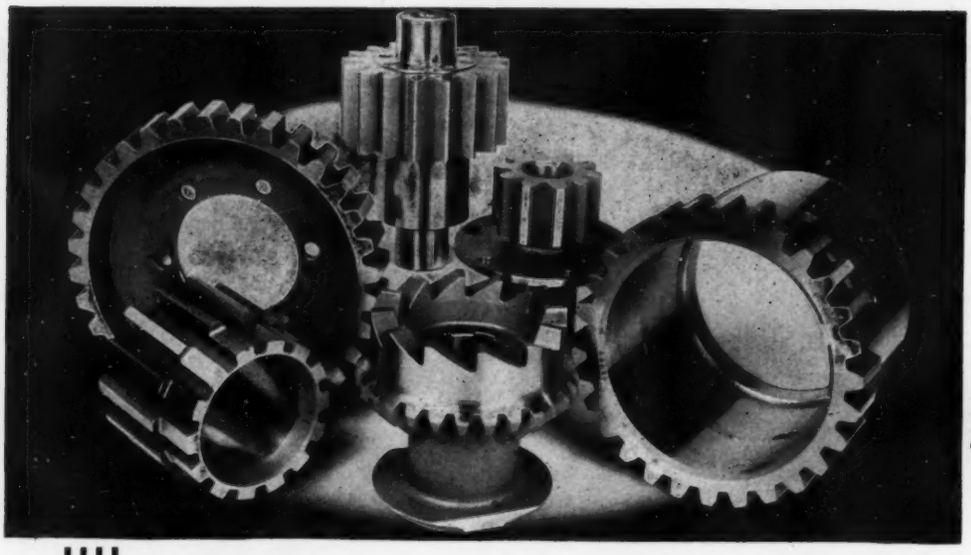

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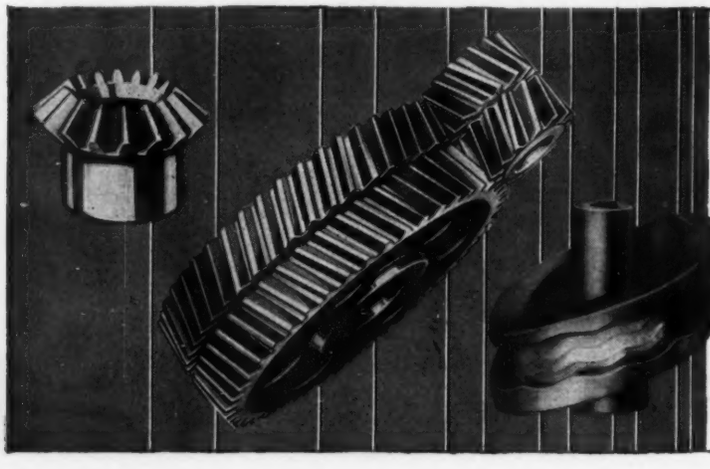

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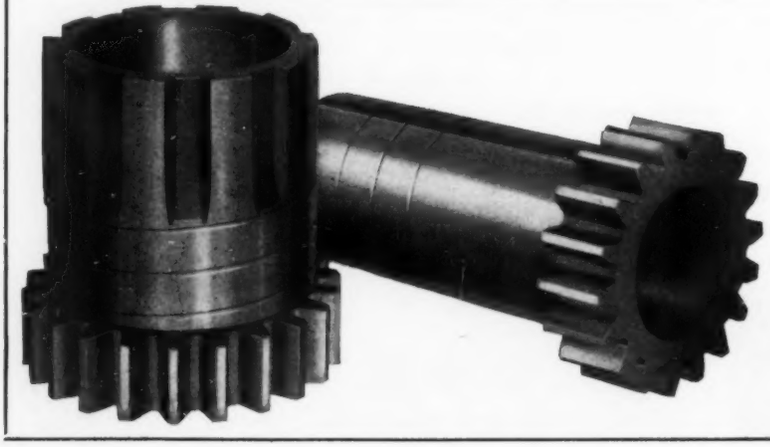

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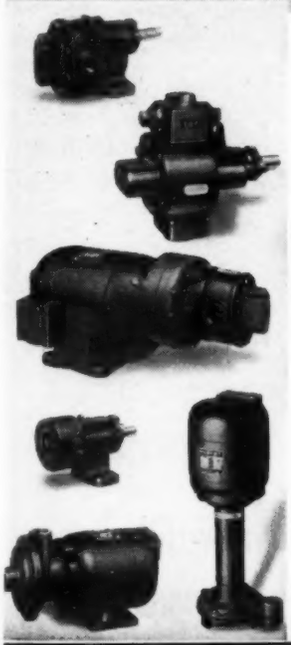

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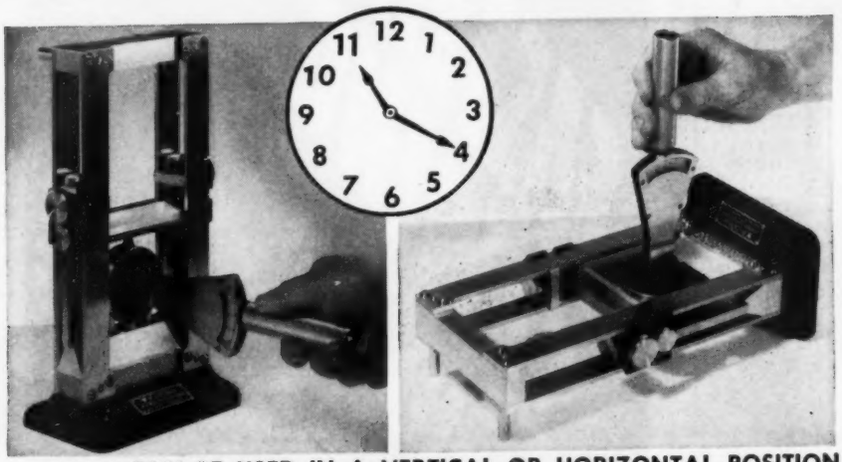

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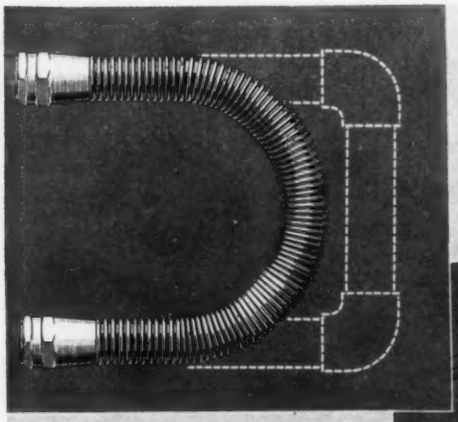
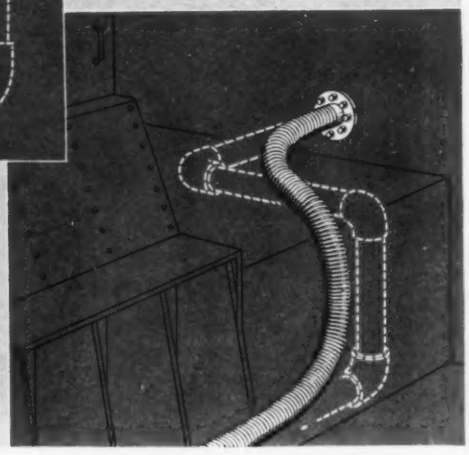


Rex Flexible Metal Hose can be bent to position by hand and coupled, in a fraction of the time required to fit a pipe connection. ←



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the official handbook of the Civilian Defense Council of the College of the City of New York

Just Out!

What should I do when alarms come, when blackouts occur, when bombs fall? How can I protect my home and family? How is civilian defense preparing for emergencies, and where do I fit in? To help you learn the answers to these questions quickly, turn to the—

How to prepare for air raid protection

At last—a manual prepared especially for the civilian. Tells briefly and plainly everything you want to know about protecting yourself, your family, your household. Answers your questions on each important element of protection *quickly, authoritatively* . . . in short, a book that puts all the vital safety information in your hands in one place, shows you what to do and how to do it, NOW and later, to protect life and property.

HANDBOOK OF CIVILIAN PROTECTION

Prepared by the Civilian Defense Council, The College of the City of New York. Edited by Louis L. Snyder.

184 pages, 5x7¼, fully illustrated, $1.25

10 DAYS' FREE EXAMINATION

Covers ALL important points:

1—Civilian Defense Organization
2—general air raid rules
3—fire fighting
4—defense against bombs
5—protection against gas
6—first aid
7—conservation and salvage of materials
8—keeping healthy by diet

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y.

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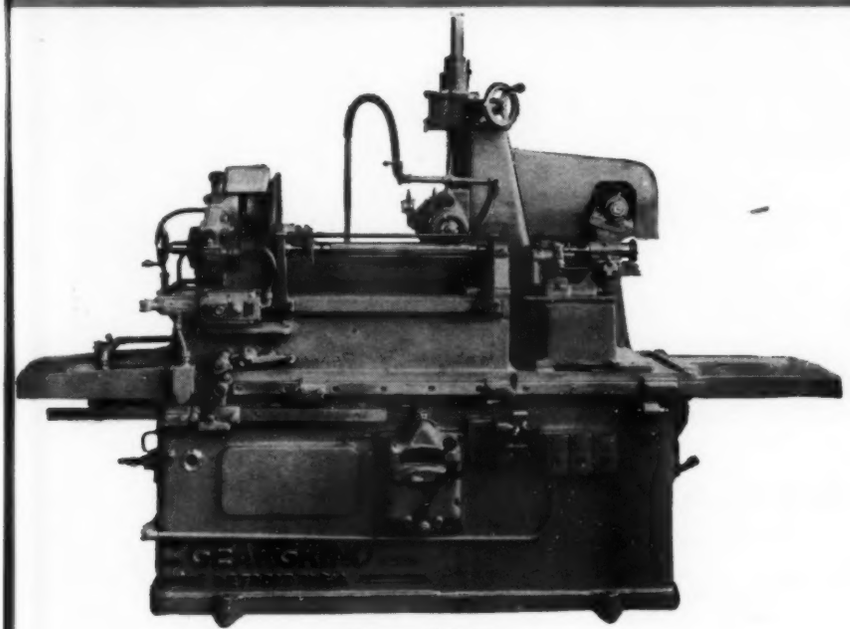
SPLINE GRINDING



Type SG-11

This is one of four GEARGRIND Spline Grinding Machines, and has a between-centers capacity of 24". Other sizes have between-centers capacities of 42", 60" and 80."

GEARGRIND Spline Grinders offer definite advantages in the production of straight, tapered and involute splines, and serrations.

1. **They produce spline gauges and spline broaches requiring *accuracy and finish.***
2. **They grind production shafts economically, while retaining close tolerances.**

These GEARGRIND Spline Grinders are characterized by careful engineering, painstaking craftsmanship, semi-automatic operation and unusual smoothness. They employ the same type of low pressure, hydraulic system that is used in the complete line of GEARGRIND Machines in the formed wheel grinding of external and internal gears, external and internal straight or involute splines, and serrations and racks.

The GEAR GRINDING MACHINE COMPANY
DETROIT, MICH. U.S.A.

Industrial Eye Accidents are Enemy Raiders, too

What a whale of a lot of difference 16 extra destroyers would make to our war fleet, right now. Yet, how much thought is given to the fact that in 1940 industrial eye accidents robbed America of 8,000,000 man-days—enough working time to have built those 16 battle greyhounds.

And last year the loss of time caused by industrial eye accidents ran even higher . . . 9,455,000 man-days.

Unprotected eyes are un-American—slow up vital production. Provide all your workers with goggles —and we'll lick the enemy raiders quicker.

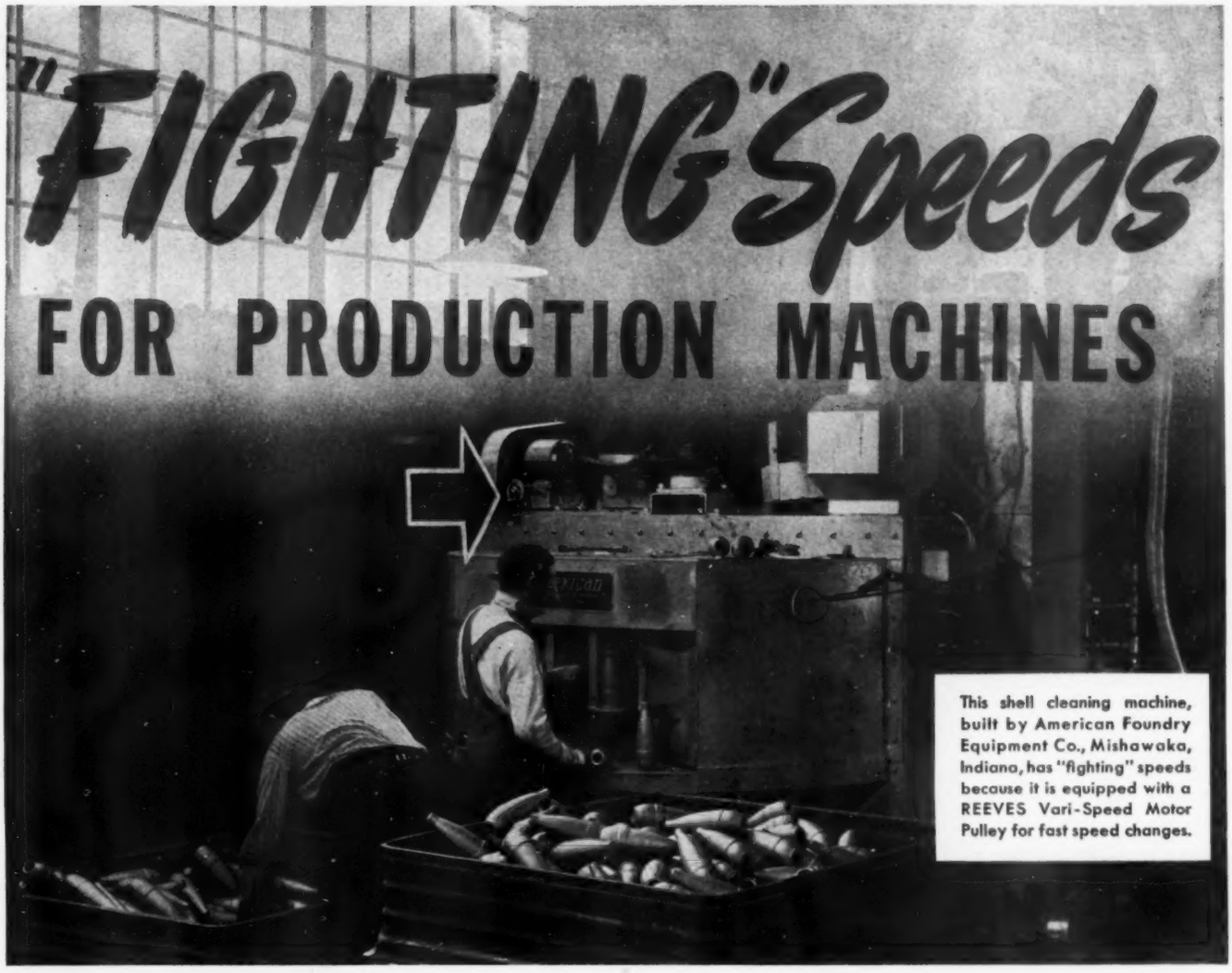
American Optical Company Goggles have been scientifically designed to provide *extra* protection and *extra* comfort . . . and there is an AO Goggle for every type of industrial eye hazard.

Make sure *your* plant has complete eye protection.

THE American Optical COMPANY

SOUTHBRIDGE *MASSACHUSETTS*

"FIGHTING" Speeds FOR PRODUCTION MACHINES



This shell cleaning machine, built by American Foundry Equipment Co., Mishawaka, Indiana, has "fighting" speeds because it is equipped with a REEVES Vari-Speed Motor Pulley for fast speed changes.

There isn't much "fight" in a machine that can't change speeds when the need comes. Stodgy, stolid, unresponsive, it just "plugs along"—incapable of being speeded up or slowed down to meet any changed condition.

But give the same machine the complete flexibility—the ability to change pace easily and quickly which comes with REEVES Variable Speed Drives, and watch production zoom!

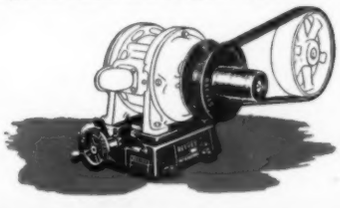
Then work flows smoothly from one machine to another, with speeds synchronized to avoid delays. Each machine operates at the very best speed for the particular job or process, to prevent waste and spoilage. As slow as is necessary for "green hands." As fast as skilled workers can keep up. Faster or slower—but always the best speed—the most efficient speed—as work in process changes size, shape or periphery.

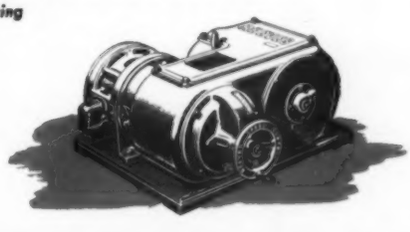
These are the advantages of variable speed control that put more "fight" in any machine. They are the advantages best exemplified in the *infinite speed adjustability, accurate speed setting and positive operation* of REEVES *Variable Speed Drives.*

If you are building a machine that is essential to our war program, write, wire or phone us. We shall do our best to supply you. Send for copy of Catalog-Manual A-419.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Field of Speed Control Engineering





VARIABLE SPEED TRANSMISSION—Provides infinite speed adjustability over wide range and for heavy duty service. Modern open and enclosed designs, vertical, horizontal. Fractional to 97 h.p. Speed variations 2:1 through 16:1.

VARI-SPEED MOTOR PULLEY—Mounts on standard shaft of any constant speed motor. Forms direct drive to machine. For light horsepower requirements to and including 7½ h.p. within 3:1 ratio of speed range.

VARI-SPEED MOTODRIVE—Combines constant speed motor, REEVES speed varying mechanism and reduction gears (where required). Space-saving horizontal and vertical types—⅛ to 10 h.p. Speed variations 2:1 through 6:1.

Engineered

Do You Have Parts of Small Arms,

On all types of milling operations for the class of work indicated above, Sundstrand No. 0 Rigidmils are giving remarkable speed, ease, and economy.

Fast—No. 0 Rigidmil speed begins with set-up. Spindle r.p.m., feed rate and operating cycle can be established very quickly. Convenient panel gives operator complete control of electric motors. After set-up, speed continues in operating cycles which include rapid traverse of 325″ a minute.

Automatic—Simple, reliable, safeguarded; the automatic cycles of No. 0 Rigidmil provide maximum output with minimum operating effort and skill. Man, woman, boy, girl — almost anyone can attain peak productive operation quickly on a No. 0 Rigidmil, and keep it up steadily without excessive fatigue.

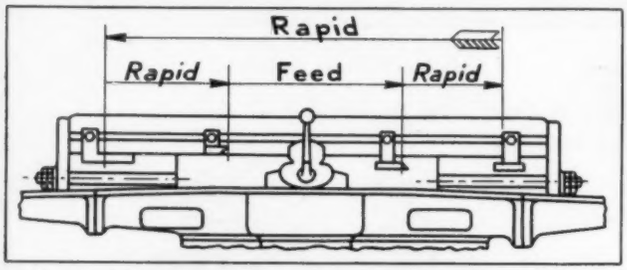
Hydraulic—Feeds for any material, kind of cut or cutter — any feed rate whatever throughout the wide range of the No. 0 Rigidmil — are secured by a simple adjustment. These, the 325″ rapid traverse, the variety of cycles and their simple control are all provided by Sundstrand patented hydraulic equipment.

Versatile—High production and accuracy on various types and combinations of milling operations can be maintained easily on the No. 0 Rigidmil. High-ratio, 48 to 1, spindle head provides speeds from 25 r.p.m. to 2400 r.p.m. in two ranges, with 61 possible changes in each range. A half-dozen standard table-control dogs suffice for setting up the most frequently used cycles; a few specials meet the unusual conditions.

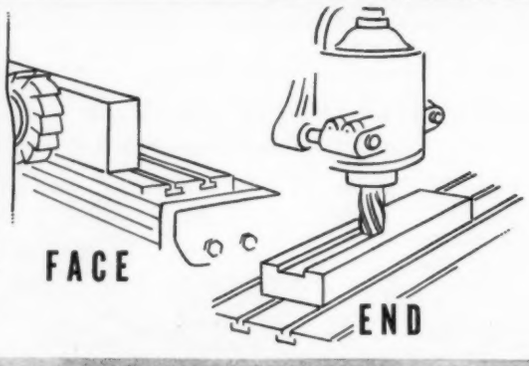
To Help You Mill More—Sundstrand Engineered Production Service gives you the benefit of priceless data files and practical experience on thousands of milling jobs, helps you solve new and unusual milling problems. Use this service freely. Send data for production proposals, without cost or obligation.

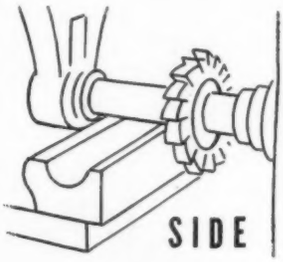
Get These Bulletins

Interesting Sundstrand publications shown at right give information about No. 0 Rigidmils; the smaller No. 00; the larger No. 1; and spindle speeds for materials ranging from steel to magnesium. All four sent promptly on request for Bulletins 101.



Unusual Rigidmil cycle above grooves brass pieces 1½″ long at 1800 an hour. Others do milling operations sketched at right in single, skip-stop or two-way set-ups.





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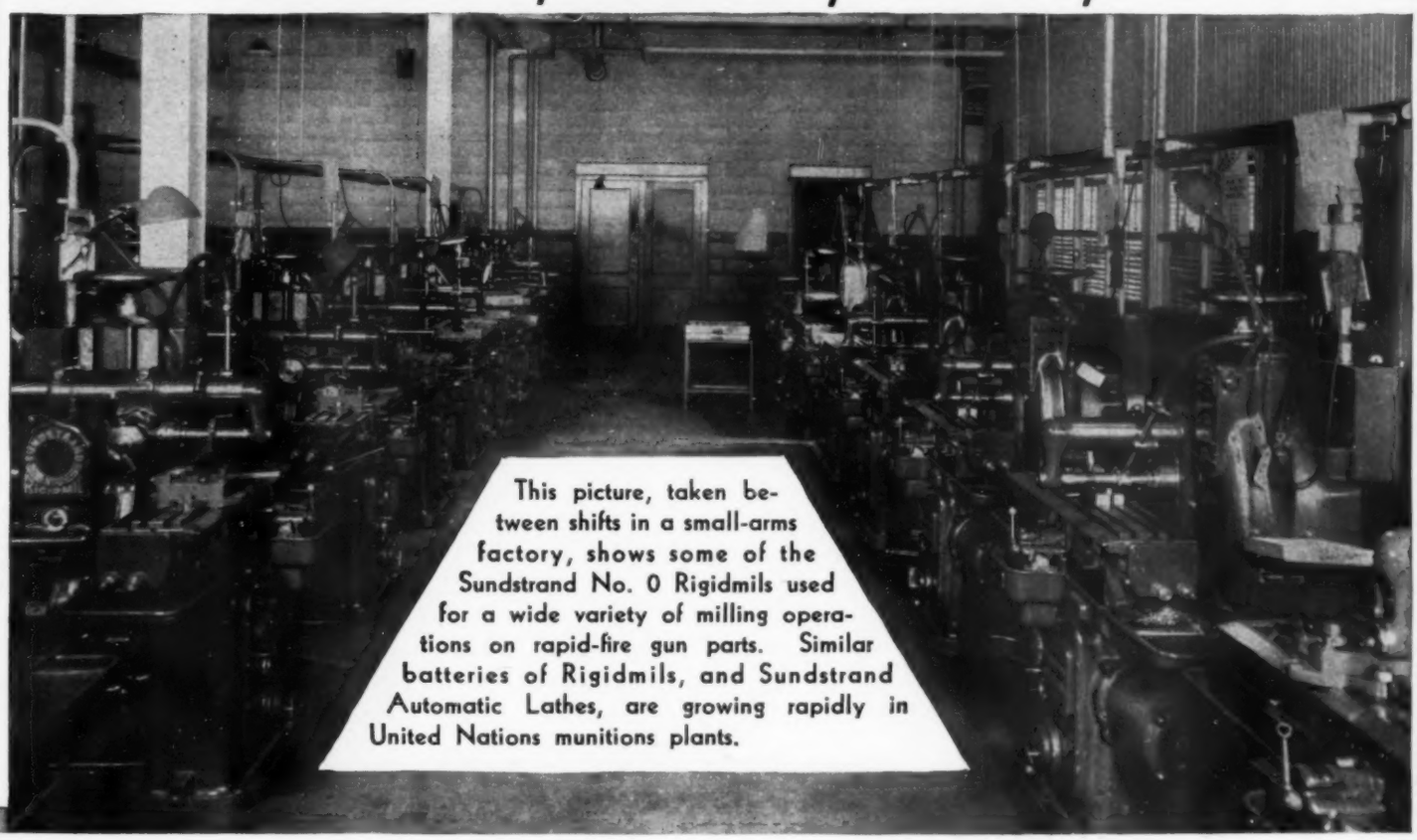
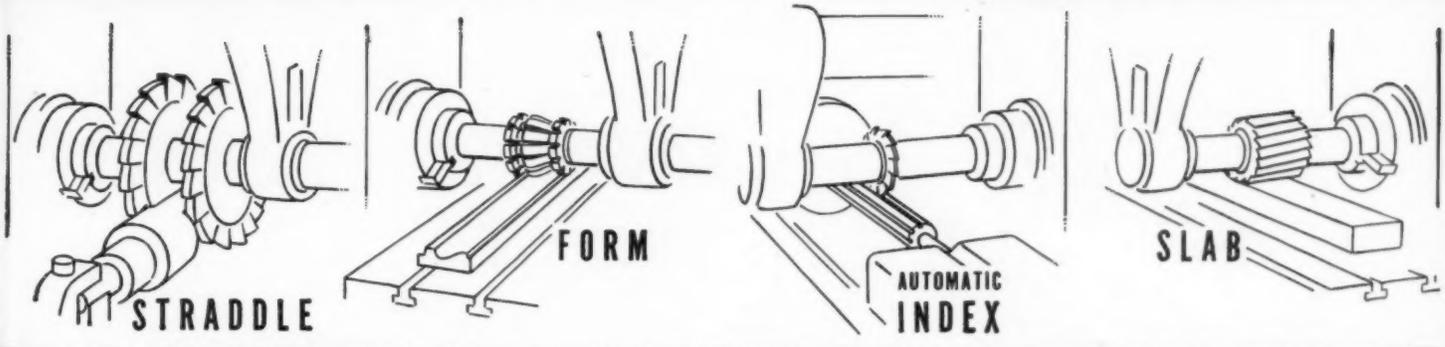
Machine Guns, Bombs, Fuses, To Mill?



This picture, taken between shifts in a small-arms factory, shows some of the Sundstrand No. 0 Rigidmils used for a wide variety of milling operations on rapid-fire gun parts. Similar batteries of Rigidmils, and Sundstrand Automatic Lathes, are growing rapidly in United Nations munitions plants.



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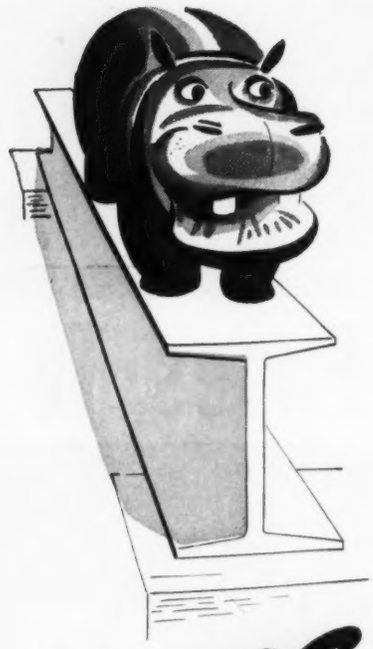

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ONE-PIECE,
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WHERE THEY'RE
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AHEAD!

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—with the same practical course developed at the Henry Ford Trade School and used in hundreds of defense schools all over the country.

Here is a 265-page instruction book, containing over 800 illustrations, making clear the fundamentals of shop work—how to use all kinds of measuring instruments; how to operate hand tools. drilling and milling machines, shapers, tapers, planers, grinding machines; explaining gears and heat treatment, etc., etc.

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265 pages, 8½x11, 820 illustrations, $1.25

ELIMINATING all non-essentials, this book gives you a quick working knowledge of the basic tools, machines, and instruments, and the fundamental operations of machine shop work. It tells you how all the machines and tools used were developed, how they are constructed and how to operate them. It explains heat treatment and gearing. It includes the mathematics needed for shop work, and stresses safety rules. Every step of machine shop work is pictured clearly both in text and illustrations.

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—every lesson job-motivated, preparing you to handle specific jobs;

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—all related information is provided; no other books are necessary;

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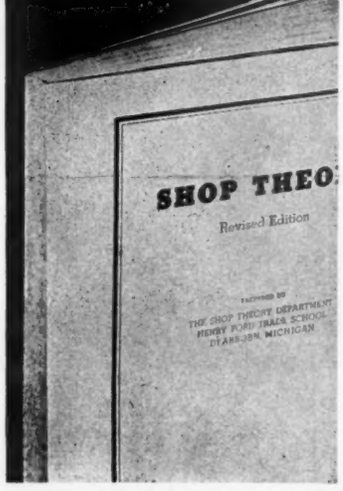

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360 HOLES AN HOUR

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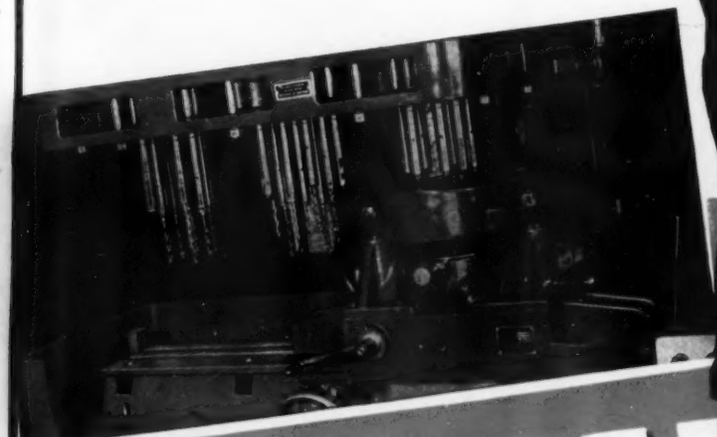
● Multiple drilling with Baush machines is being relied upon to speed up production in many plants engaged in war work. In addition to providing quick set up, Baush machines can be tooled for a wide variety of drilling, boring, tapping and reaming jobs.

● In one case, 360 holes per hour are being drilled in an airplane part. In another, a Baush Multiple Drill has reduced operating time on a job from a previous 80 minutes to 12 minutes, thereby speeding production and cutting costs while maintaining strict accuracy under a 16-hour a day, 6-day week operating schedule.

● Manufacturers seeking speed today and economical production in the years ahead, rely on Baush.



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For over 45 years Baush has pioneered in multiple drilling. Expert engineering service is available. Write, wire or phone today.

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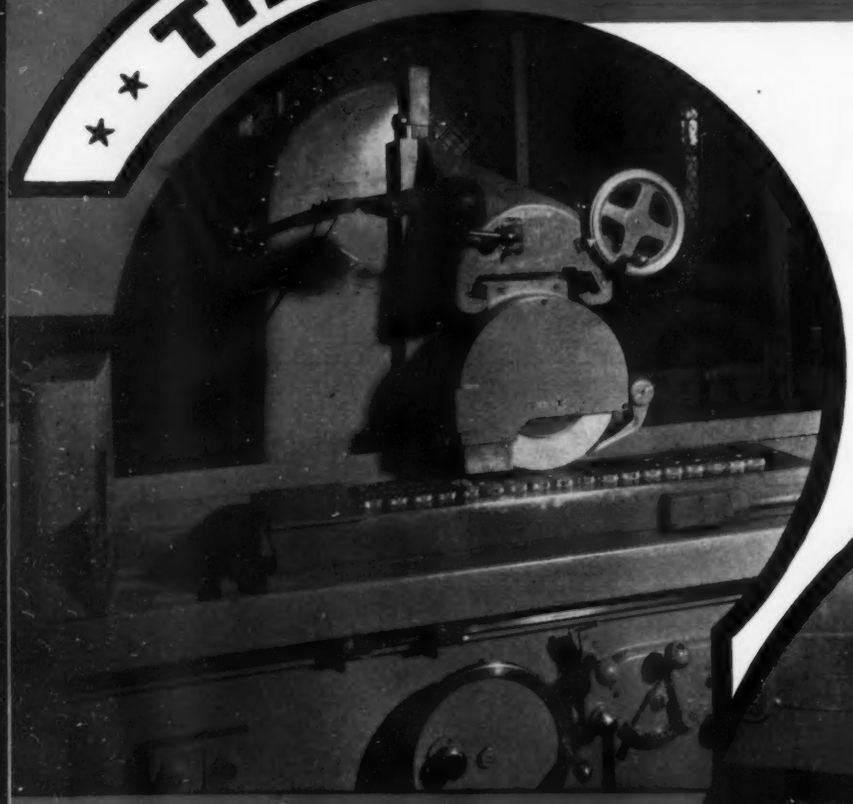
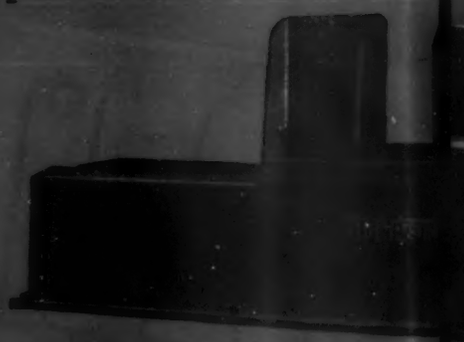


1 54 Thread Ring Gauges ganged on Thompson Grinder. Breach Lock Gages are also ground on this machine to .0001" limit for a leading manufacturer of visual and other type gauges. They claim Thompson is faster and holds closer tolerances.

2 Typical Thompson War Jobs. Grinding a group of fourteen 4.571" dia. gears at one time at the rate of .03 minute each for a well known machine tool builder.

3 Thompson Grinder is grinding parts for a large manufacturer of aircraft for our armed forces. Accuracy is a "must" on this job.



TH

THOMPSON GRINDER

★ In machine tool plants—in precision gage plants —in Airplane plants—in tank and gun plants—in fact wherever smooth, close, tolerance work is required on a high production basis you'll find Thompson Grinders.

For those plants now being converted to all-out war production there are many jobs requiring most exacting tolerances on exceptionally smooth ground surfaces which will be done faster—better—at lower cost on a Thompson Grinder.

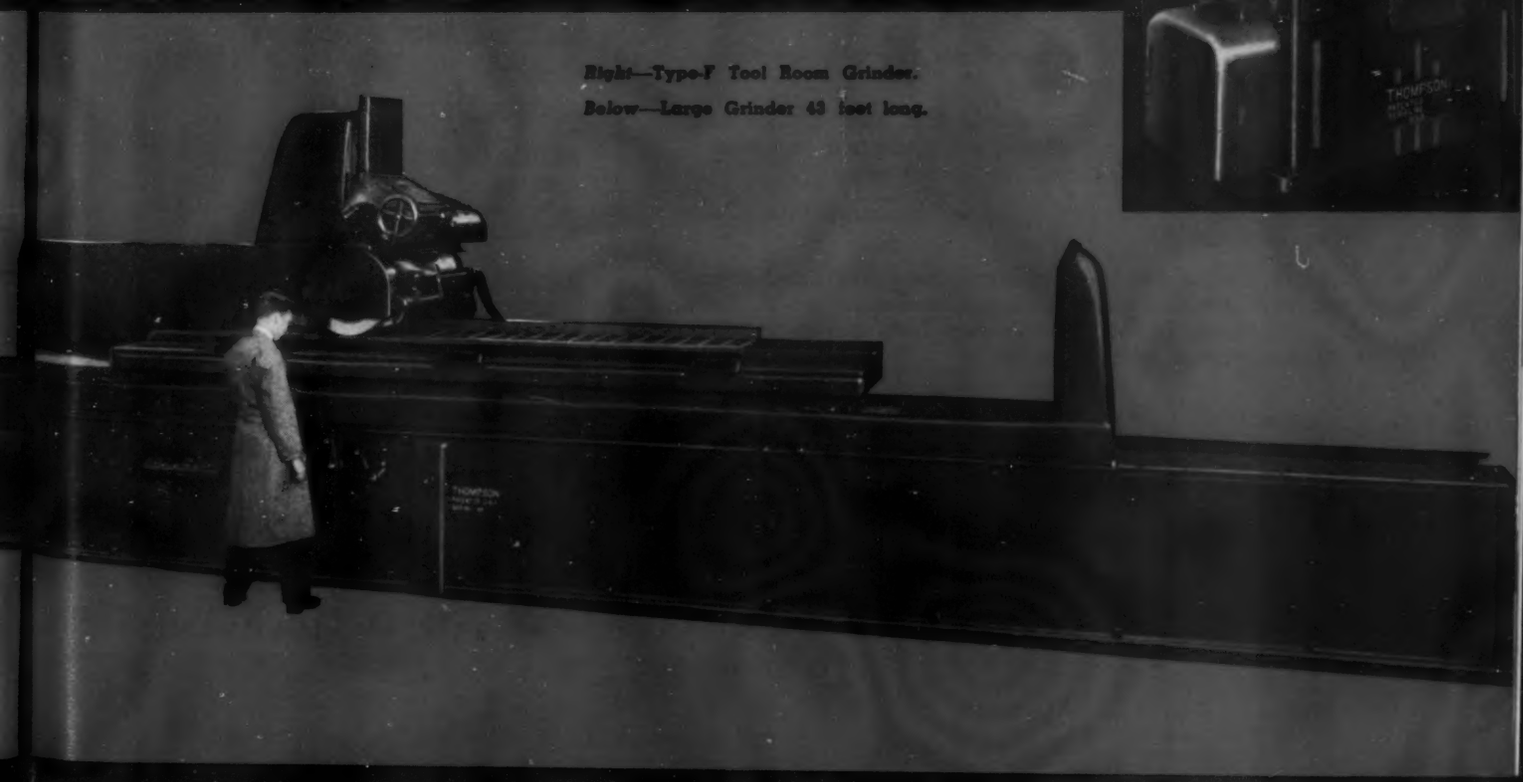
Thompson offers a full range of Grinders from the small Type F Tool Room unit to the Type C 36″ x 36″ x 220″. Both machines feature a smooth, shockless full hydraulic table drive—magnetic table chuck—full automatic pressure lubrication to bed ways and head slide ways—centralized control—all of which make for greater accuracy and increased production. Thompson also has built one of the largest surface grinders known—43 ft. long weighing 88,000 pounds.

Ideally suited to war plant conversion because of its flexibility and ability to maintain the close tolerances required plus unusually high production.

For complete details on the various types write for catalog.

THE Thompson GRINDER COMPANY
SPRINGFIELD OHIO

Right—Type-F Tool Room Grinder.
Below—Large Grinder 43 feet long.



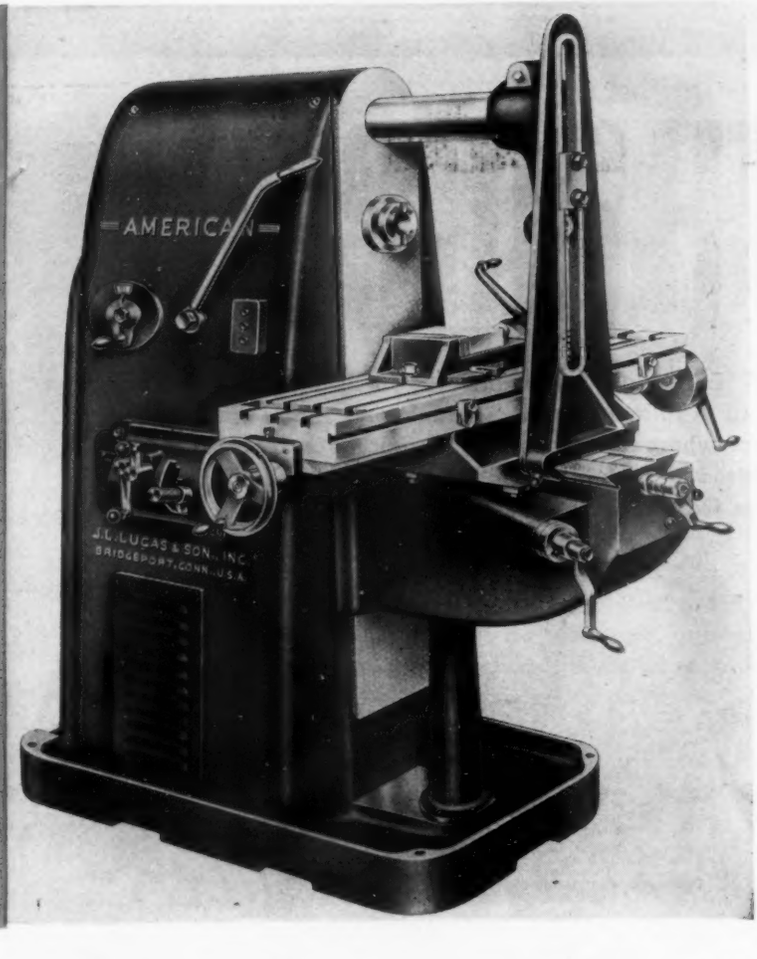
No. 2

American PLAIN MILLING MACHINE

featuring

★ INFINITE SPINDLE SPEEDS
★ MOTOR-IN-BASE DRIVE
★ STANDARDIZED SPINDLE NOSE
★ HEAVY RUGGED CONSTRUCTION

Applicable to the Needs of National Defense . . .



Designed and built to assure speed, accuracy and convenience in handling a wide variety of work, the No. 2 American Plain Miller can be of outstanding help in any shop engaged in armament production.

. . . spindle is heat treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings; a standardized flange spindle nose is used having a number 40 taper.

. . . motor in base is the U. S. Vari-Drive, ball bearing throughout.

. . . infinite variations in speed are instantly available while machine is in operation.

. . . convenient controls for speed and feed are located centrally for ease of operation; all operating levers are placed for manipulation with minimum effort.

. . . heavy column completely houses motor drive and all power shafts.

. . . table is designed for sturdiness and maintained alignment with working surface having generous oil pockets and with three Tee-slots; table has both power longitudinal and power transverse feeds.

CONDENSED SPECIFICATIONS

TABLE WORKING SURFACE – 46" x 10½"

LONGITUDINAL POWER FEED – 25"

TRANSVERSE POWER FEED – 9"

VERTICAL HAND FEED – 19"

MAX. DISTANCE SPINDLE TO TABLE – 19"

SPINDLE SPEEDS – Infinite

RANGE OF SPINDLE SPEEDS – 25-500 R.P.M.

NUMBER OF GEARED FEEDS – 16

RANGE PER SPINDLE REVOLUTION – .005" to .212"

NET WEIGHT – 4240 LBS.

COMPLETE DETAILS AVAILABLE PROMPTLY ON REQUEST

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All Sizes and Lengths

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APPROXIMATE ACTUAL
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Normally Open Poles can be quickly changed to Normally Closed Poles and vice versa, using only a screwdriver. No additional parts are needed for these changes.

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Bulletin 7323 Wee-C-Relay can be mounted in any plane, and is resistant to false operation from shock.

Large diameter, Silver to Silver Contacts provide long life with minimum maintenance.

This Relay is available in combination with Transformer for Low Voltage operation.

It can be used with either A. C. or D. C., and can also be used as a Size 00, 10 Amp. Contactor on small or fractional H. P. motors.

Ask for fully descriptive Bulletin 7303.

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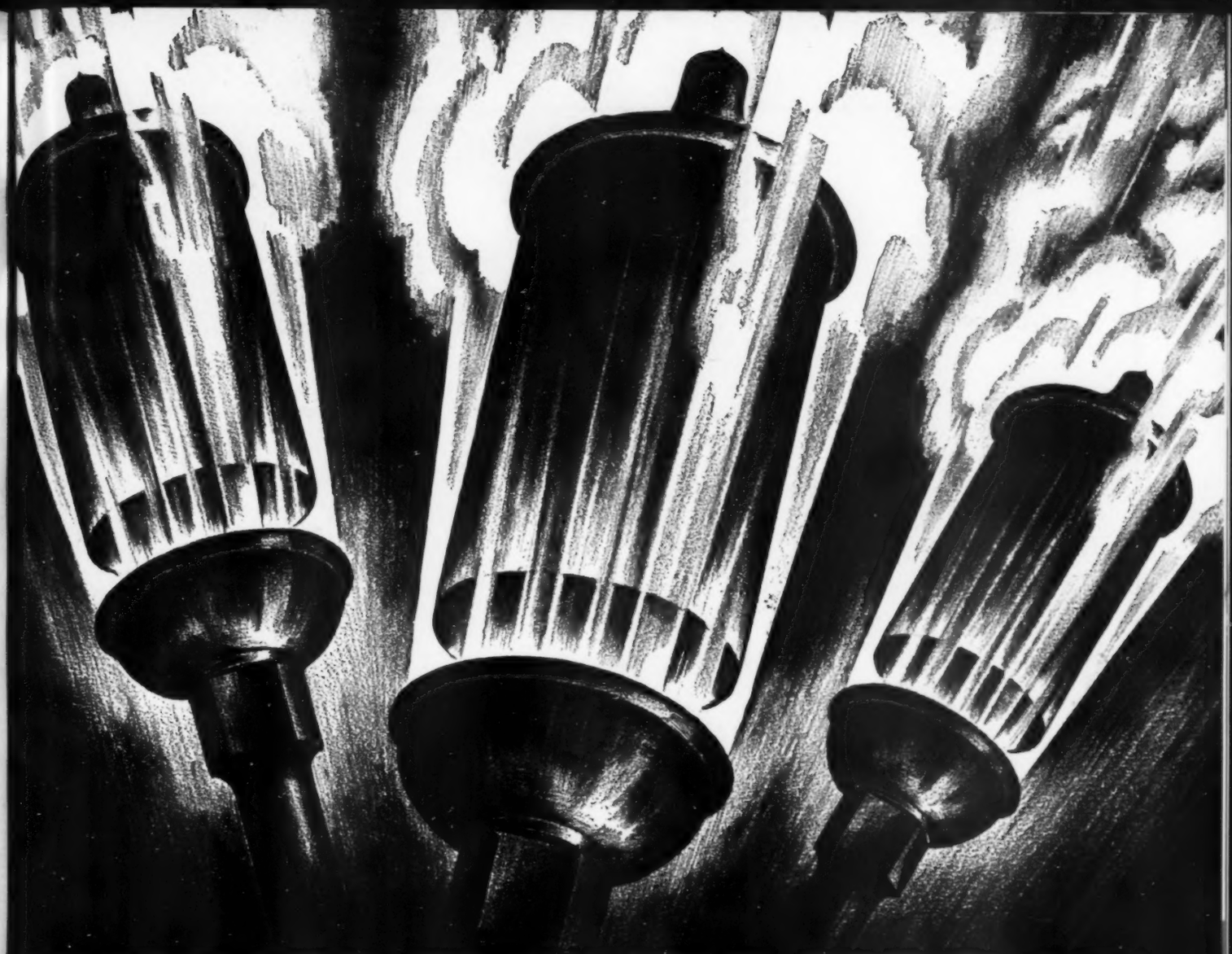

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Twenty-four hours a day, the men at Williams' keep the hammers thundering... forging tools of war for our far-flung industrial and fighting fronts! • In common with most of America's industry, we are sparing no energy, human or mechanical, in an "all-out" effort to build *more*... to build *better*... to build *faster!* Victory is the reward we hope to share...and with it, a better, happier and kindlier tomorrow.

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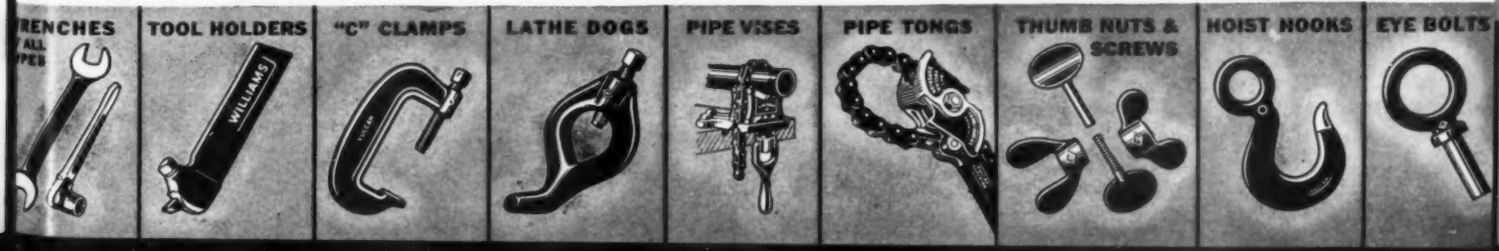

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"It wasn't the money. We were rushed and I took the easy way out."

It looked like a standard torque motor might do it . . . not ideally, but I figured it would get by. It was a new machine . . . we had orders and the customers were giving us the rush act . . . we started to ship 'em powered with stock motors . . . good stock motors.

That was just a few weeks ago. The telegrams and phone calls are still coming in . . . they're all the same POWER FAILURE.

Now we're doing what we should have done in the first place. We've got WELCO working 24 hours a day building a custom torque motor to do our power job right.

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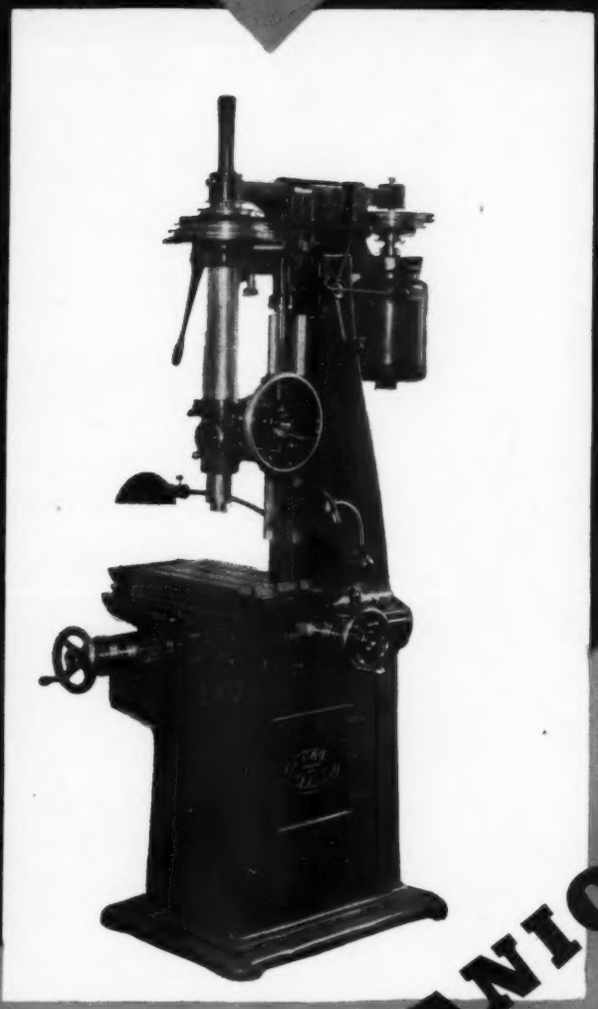
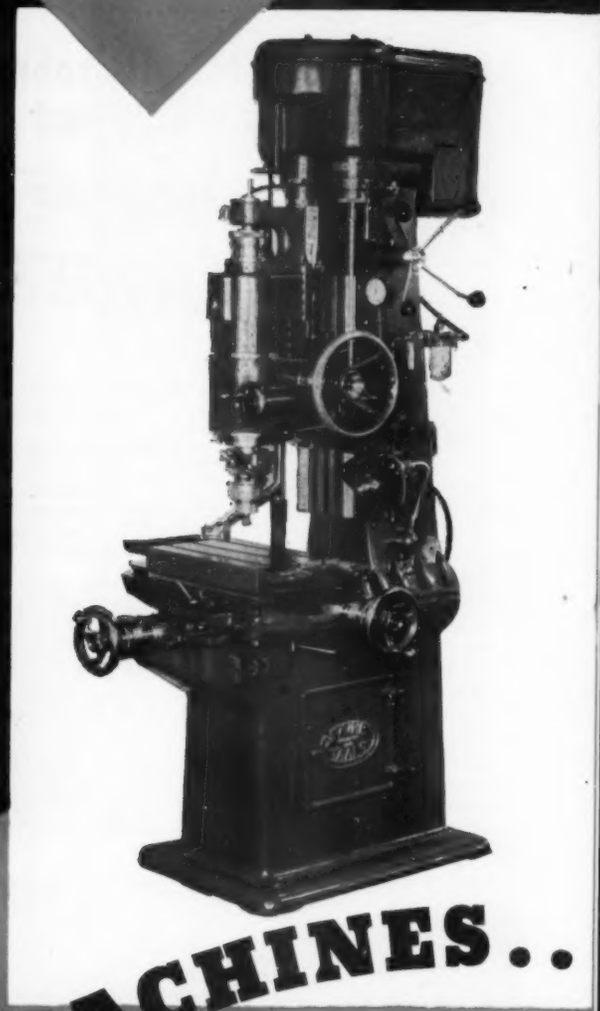
BY ALL MEANS STANDARDIZE WHERE YOU CAN, BUT THE RIGHT TORQUE MOTOR FOR THE RIGHT JOB DOESN'T *ALWAYS* JUST HAPPEN — OFTEN IT'S DESIGNED.

The B. A. WESCHE ELECTRIC CO., 1626 Vine St., Cincinnati, Ohio

MOORE JIG BORER

MOORE JIG GRINDER





COMPANION MACHINES . .

contributing to the maximum in speed and precision on armament tool and die work . . .

Spotting, drilling, reaming and boring — at big time savings—on the MOORE JIG BORER

Advanced in design and proved in use, this machine will produce more holes to closer accuracy limits in less time.

Spindle supported on four pre-loaded ball bearings; ten spindle speeds from 100 to 2600 R.P.M.; table working surface 10"x16"; table top to spindle end—3" min., 16" max.; boring capacity (with two speed motor) 3½" tool steel, 4" soft steel.

Relocating and grinding holes — faster and more accurately — on the MOORE JIG GRINDER

This machine—a companion to the Jig Borer—meets every requirement for time savings and utmost accuracy in grinding straight or tapered holes to size and location in hardened steel parts.

With a grinding capacity from .030" to 4", accuracy of screws of .00005" per inch and grinding speeds of 15,000, 25,000 and 45,000 R.P.M., the Moore Jig Grinder is ideally suited to operations on dies, drill jigs, master plates and precision gage parts.

BULLETINS giving complete details on these two indispensable companion machines are available promptly on request. Write today.

Manufactured by

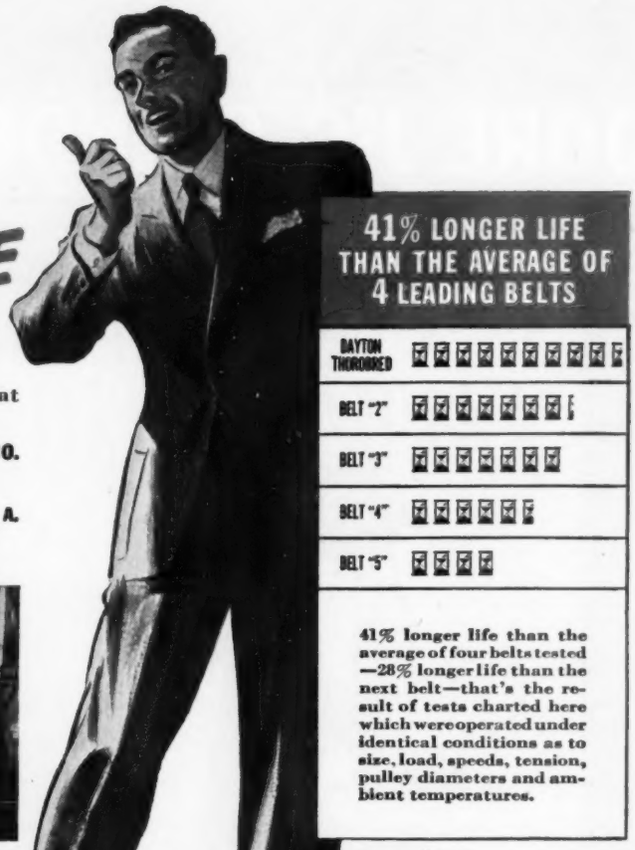
THE MOORE SPECIAL TOOL CO., INC.

BRIDGEPORT, CONNECTICUT

Exclusive Sales Representative: MARBURG BROTHERS, Inc., 90 West Street, New York City

Because this Thorobred has a Fighting Heart...

YOU GET AS MUCH AS 41% LONGER LIFE



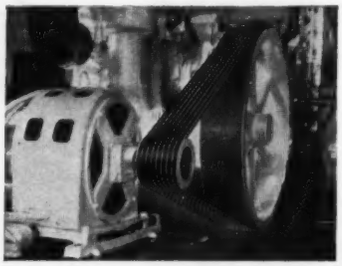
41% LONGER LIFE THAN THE AVERAGE OF 4 LEADING BELTS

DAYTON THOROBRED	
BELT "2"	
BELT "3"	
BELT "4"	
BELT "5"	

41% longer life than the average of four belts tested —28% longer life than the next belt—that's the result of tests charted here which were operated under identical conditions as to size, load, speeds, tension, pulley diameters and ambient temperatures.

Beneath the tough, sleek, black coat of the Dayton Thorobred Wrapped-Molded type V-Belt, there is a fighting heart of Daytex Cord—a heart built right into the Thorobred with its three prime sections (a construction principle pioneered and patented by Dayton). The test evidence of the extra long life that the Dayton Thorobred gives you, as contrasted to other leading belts, is shown on the chart reproduced here. But the very best evidence of the Thorobred's performance is the hundreds of field applications in many important industries. These applications prove beyond question that the Thorobred is everything that its name implies.

THE DAYTON RUBBER MFG. CO.
Dayton, Ohio
DAYTON RUBBER EXPORT CORP.
38 Pearl Street, New York, N. Y., U. S. A.
THE WORLD'S LARGEST MANUFACTURER OF V-BELTS



Dayton Thorobred V-Belts

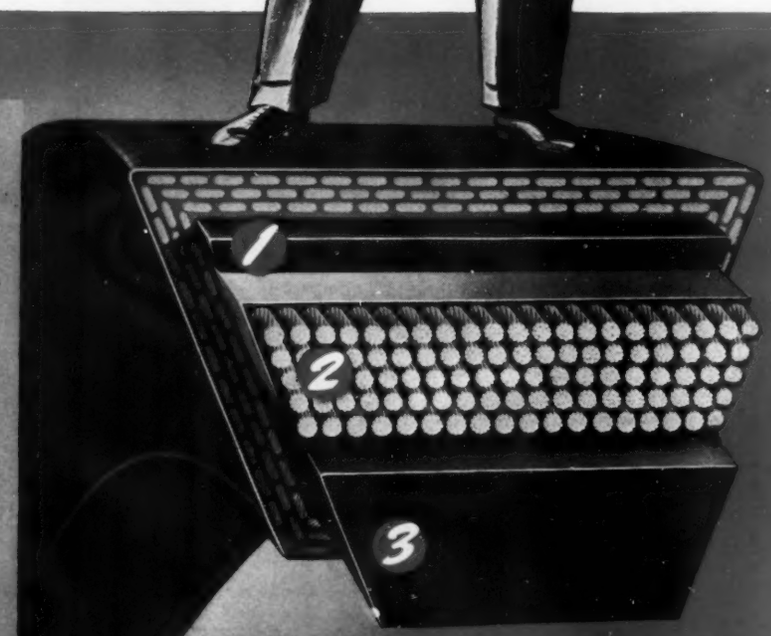
3 PRIME SECTIONS

Under the tough, rugged black cover which resists dust, moisture and other elements, are Dayton's 3 prime sections.

1. **THE TENSION SECTION**—Live, heat-resistant rubber compounds provide the "give" necessary to efficient and cooler-running performance.

2. **THE DAYTEX CORD NEUTRAL SECTION**—The fighting heart of the Thorobred—famed Daytex Cord imbedded in strong, live rubber compounds.

3. **THE COMPRESSION SECTION**—Fibres run crosswise to achieve great cross-sectional rigidity, less distortion in pulley grooves.



Dayton V-Belts

LIFELINES OF POWER VITAL TO VICTORY

THE GREATEST NAME IN V-BELTS

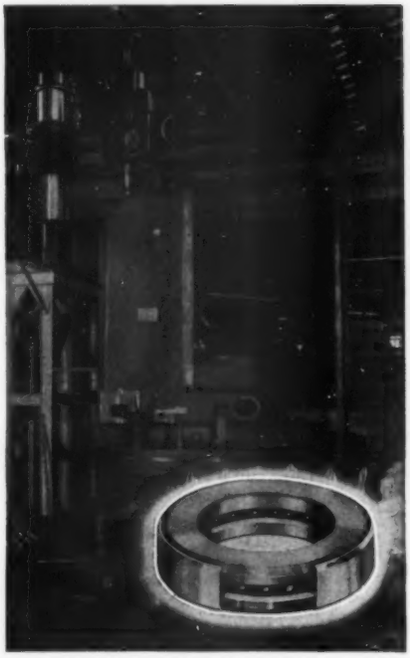
Copyright, 1942, The Dayton Rubber Mfg. Co.

IN THE NEWS

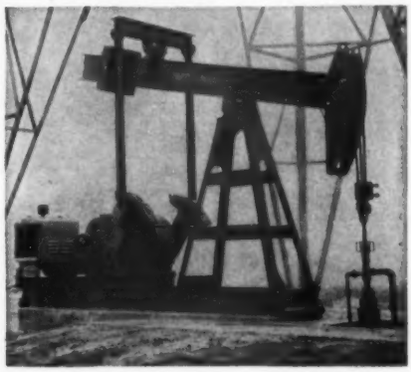
WITH BANTAM BEARINGS

REPLACING A LOCOMOTIVE is all in a day's work for this worm drive towing winch used to move freight cars into position to facilitate even loading. Built by Willamette Hyster Company, it employs Bantam Quill Bearings in the idler gears of the transmission. As shown in the drawing, these compact Quill Bearings are particularly well adapted to the limited clearances available. And, in addition, the high load capacity of Quill Bearings aids the Hyster Winch in handling tough jobs efficiently and with minimum power loss.

IN THE GIGANTIC TASK of moving America at war—"Freightliners" are providing swift, safe convoy for raw materials, munitions, supplies and equipment. Built by Freightways Manufacturing Company, these dual trailer units use Bantam Quill Bearings for long, dependable service.



THE BACKBONE OF INDUSTRY are machine tools such as the radial drill shown here, mounted on a platform for high altitude work in the plant of one of the Nation's largest machine manufacturers. Made by the Morris Machine Tool Company, this drill uses Bantam Radial Ball Bearings—a typical example of Bantam's service in the design and engineering of bearings for all types of applications.



VICTORY OR DEFEAT in this war may depend on oil. Pumping units like this one, built by The Happy Company, are operating on a 24-hour basis to supply this vital source of power for American planes, tanks, and trucks. To assure efficient operation and long service life with a minimum of attention, Bantam Quill Bearings are used in equalizers, center iron saddles, other points of wear. The high unit capacity of these low-cost anti-friction bearings also helps simplify design.

PROMPT DELIVERY OF SPECIAL BEARINGS is offered by Bantam because Bantam is tooled-up to manufacture made-to-order bearings with a minimum of delay. And the cooperation of Bantam's engineers is available to aid you in the design of such bearings. Or, if you have a standard application, remember that Bantam makes every major type of anti-friction bearing—straight roller, tapered roller, needle and ball. No matter how urgent your need or difficult your problem, for experienced engineering counsel or for prompt deliveries on essential jobs—TURN TO BANTAM.

BANTAM BEARINGS

STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL

BANTAM BEARINGS CORPORATION • SOUTH BEND • INDIANA

"Commercial" ANNULAR BALL BEARINGS

ACCURATE

STRONG

STURDY

BALL BEARINGS FOR EVERY PURPOSE

SPECIALLY DESIGNED FOR SPECIAL SERVICE

WE have the skill, knowledge and experience necessary for manufacturing many different types of ball bearings such as we illustrate on this page.

"Commercial" Annular Ball Bearings are used in widely diversified products—cultivating machines, typewriters, textile machinery, radios, scales, coal mine conveyors and other uses too numerous to mention.

SCHATZ **"Commercial"** Ball Bearings are famous for uniformly good workmanship, load capacity and endurance. Send for latest catalog.

THE SCHATZ MANUFACTURING CO.
POUGHKEEPSIE, N. Y.

Detroit Office: 2640 Book Tower • Chicago Office: 902 S. Wabash Ave.
Cleveland Office: 402 Swetland Building • Los Angeles Office: 5410 Wilshire Blvd.

New INSTRUCTIVE BULLETIN ON BROACHES

"Illinois Engineers" have prepared a highly interesting bulletin on *The Elements of Broach Design*. It provides much helpful information for tool designers as indicated by the following partial summary of its contents:

1. Definition of chip capacity
2. Chip size
3. Selection of tooth spacing
4. Selection of thickness of cut
5. Determining overall broach length
6. Cutting angles—both hook angle and back clearance
7. Cutting force and strength of broaches and their relationship

This bulletin is part of the "Illinois Technical Data Series" which is being developed and offered to tool users as a constructive effort in solving vital production problems. To receive this broach bulletin and announcements regarding future releases, send a request on your company letterhead—write today!

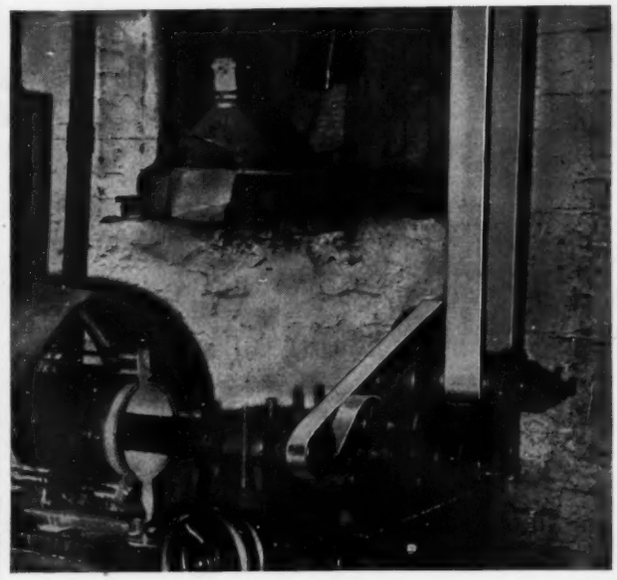
ILLINOIS

High Speed Production Tools
Hobs • Broaches • Shaper Cutters
Milling Cutters
Ground Form Tools • Special Tools
★ ★ ★
Gear Measuring Machines
Gear Measuring Blocks
Die Filing Machines

ILLINOIS TOOL WORKS

MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS
2501 N. Keeler Avenue, Chicago, Illinois • **In Canada: Canada Illinois Tools, Ltd., Toronto, Ont.**

GET MORE PRODUCTION FROM PRESENT MACHINES!



Keep present equipment operating at top efficiency and insure the best performance from new or revamped machines with Tannate flat leather belting.

Years of dependable service are built into every Tannate belt. Great strength and firm pulley grip keep machines running smoothly at full capacity even under varying load conditions. High temperatures (170°F. wet and 212°F. dry) moisture, machine oil and many weak chemicals have little effect on Tannate. And, Tannate will stay on the job 24 hours a day, seven days a week with little maintenance and infrequent shutdowns.

Let Tannate speak for itself with increased output, longer servicelife, reduced costs. Why not give a trial in your plant?

J. E. RHOADS & SONS

Established 1702

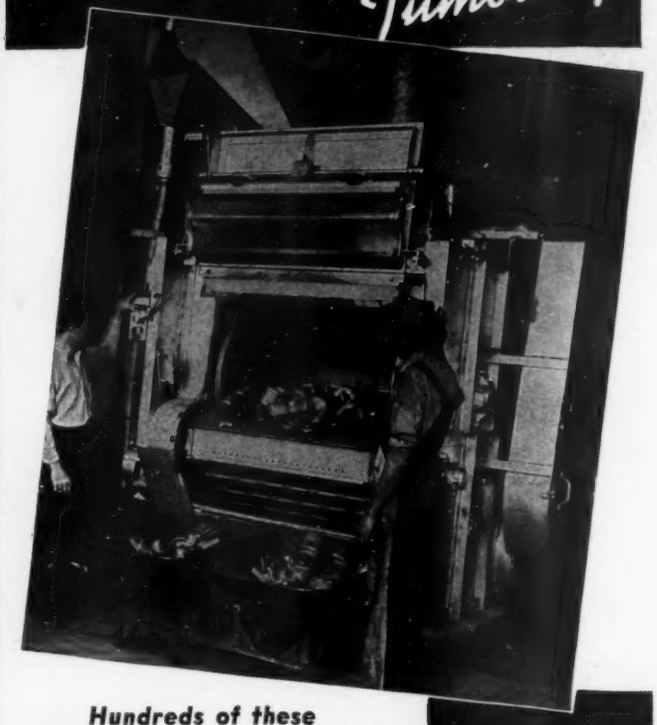
35 North 6th Street, Phila., Penna.

NEW YORK • CHICAGO • ATLANTA • CLEVELAND

STEP UP PRODUCTION with

RHOADS *Tannate* WATERSHED LEATHER BELTING

RBC *helps keep* WHEELABRATORS *Tumbling*

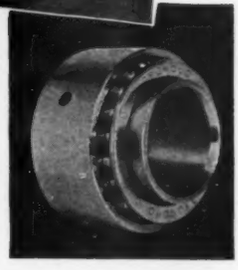


Hundreds of these

WHEELABRATOR TUMBLAST

Machines—manufactured by American Foundry Equipment Co.

—and now in service—are equipped with



RBC ROLLER BEARINGS

For 7 years RBC Anti-Friction Bearings have helped American Wheelabrators hold down their customers' operation and maintenance costs. These bearings used in the heart of the machine, the apron conveyor shafts, take the punishment of the continual tumbling of heavy castings. American reports, ". . . the bearings are very acceptable . . . and their use in the many machines in service is a recommendation of their value to us." On any problem affecting smoother, more economical operation of moving parts, put it up to RBC Roller Bearings. Send for Catalog with full engineering data.

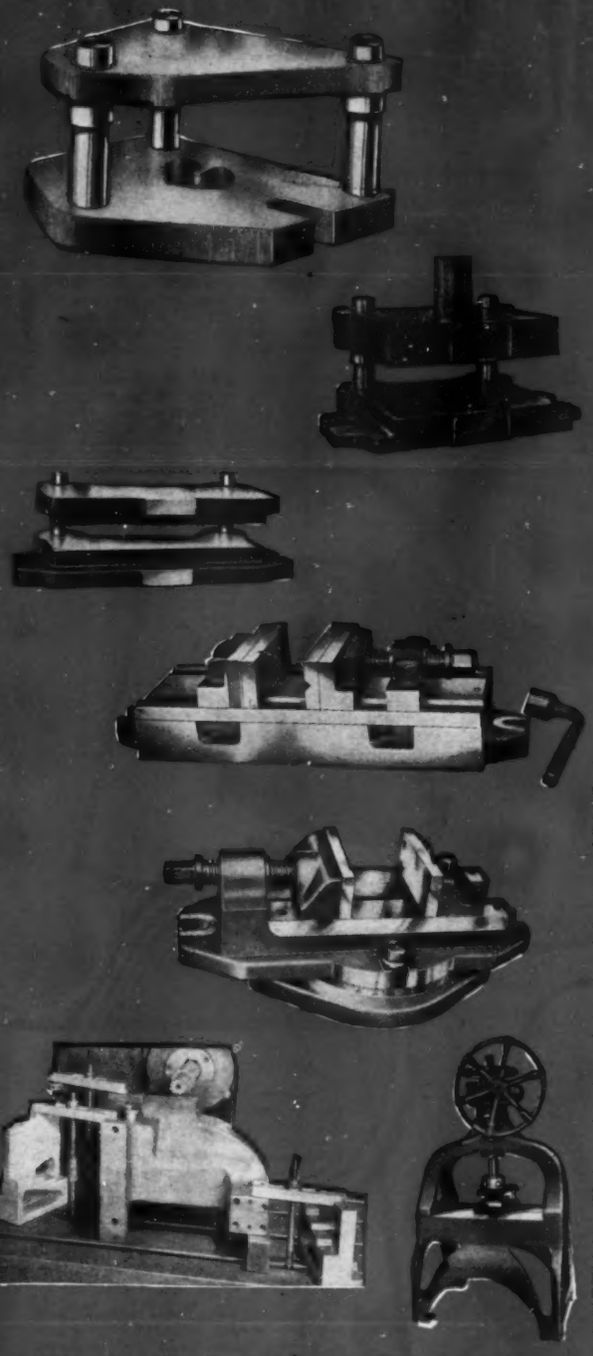
ROLLER BEARING COMPANY *of* AMERICA

TRENTON . . . . NEW JERSEY

PRODUCTO

DIE SETS — MACHINE VISES SET-UP TOOLS — UTILITY PRESS

WILL HELP YOU TURN OUT MORE MUNITIONS



FAST SERVICE TO DIE MAKERS ON PRODUCTO DIE SETS

Complete, quick service for Die Makers in every part of the country is offered by Producto. Assembly and warehouse facilities are available at Bridgeport, Conn., Detroit, Mich., and Cleveland, Ohio. In addition complete facilities are available at Detroit for manufacturing, assembling and shipping all cataloged Producto Standard and Special Die Sets.

Ohio, Western Pennsylvania and West Virginia are served by the Die Supply Co., 1390 E. 30th St., Cleveland, Ohio.

Pacific Coast requirements are handled by Joseph C. Fletcher, 1415 Folsom St., San Francisco, Cal., and Frey Industrial Supply Co., 3828 Santa Fe Ave., Los Angeles, Calif.

Middle Western points are served by motor truck from Detroit, Mich.

Producto Die Sets are available in semi-steel or steel for mounting dies, power presses, plastic molds and die castings. Accessories include Dowel Pins, Stripper Bolts, Bolster Plates, Torch Cutting and Welding Steel Plate. Write for the Producto Catalog.

SECURE, ACCURATE HOLDING ASSURED BY PRODUCTO MACHINE VISES

Work is supported and clamped on hardened surfaces. Bodies of semi-steel, reinforced with hardened and ground wearing surfaces, and jaw guide plates are practically indestructible. Accuracy is assured in every position of jaws which are adjustable in any desired position and which provide extra large openings. 4½" x 6" Screw Action types. 4"-5"-7" Cam Lock Production Vises.

Producto Vises are available for both heavy duty and general purpose milling and drilling. Full details on request.

A WIDE RANGE OF UTILITY IS OFFERED BY PRODUCTO TIME-SAVING SET-UP TOOLS

Time savings, convenience and safety in setting up and clamping are assured by these standardized Producto tools. They are applicable to a wide range of machining operations. Included are: "Build Up" Steel Blocks, "T" Slot Nuts and Bolts, Work Holding Clamps and Adjustable Clamp Screw Jacks. Ask for bulletin giving valuable information on applications.

SPEED AND CONVENIENCE ARE AVAILABLE IN THE PRODUCTO UTILITY PRESS

Investigate the possibilities of this versatile general purpose machine for shop or tool room service. It is powerful, convenient, fast and sturdy and because of its adaptability assures time savings on many operations. Write for detailed specifications.

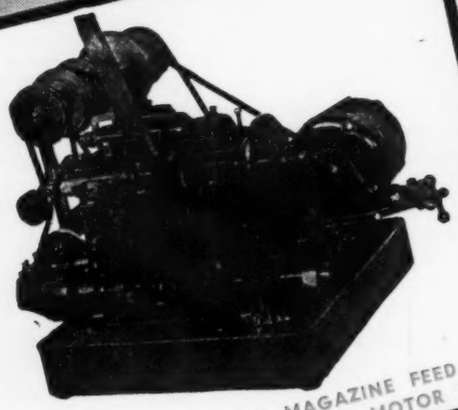
Complete, detailed information on Producto Equipment is available promptly on request.

THE PRODUCTO MACHINE COMPANY

990 HOUSATONIC AVE., BRIDGEPORT, CONN.
3017 MEDBURY AVE., DETROIT, MICHIGAN
Distributors of Dickermann Automatic Press Feeds

WALTHAM MACHINES

INSURE HIGH PRODUCTION WITH MAINTAINED ACCURACY



WITH MAGAZINE FEED AND MOTOR DRIVE

WALTHAM AUTOMATIC PINION AND GEAR CUTTERS

Any operator can produce parts quickly and accurately to toolroom standards on these fast, compact, automatic machines. Shortage of skilled labor is no handicap to using these machines effectively and economically.

High production of small gears and pinions is definitely assured because these Waltham machines have the power and speed to handle a large quantity of work in short time. For small pinions fully automatic operation may be obtained by using a magazine fed machine specially designed for this work.

Waltham Pinion and Gear Cutters are ideal for the production of such parts as watch, meter and gauge pinions, gears and sectors. Cutters for these machines and other machines are available from Waltham. Investigate TODAY by sending for detailed information.

ARCH TYPE

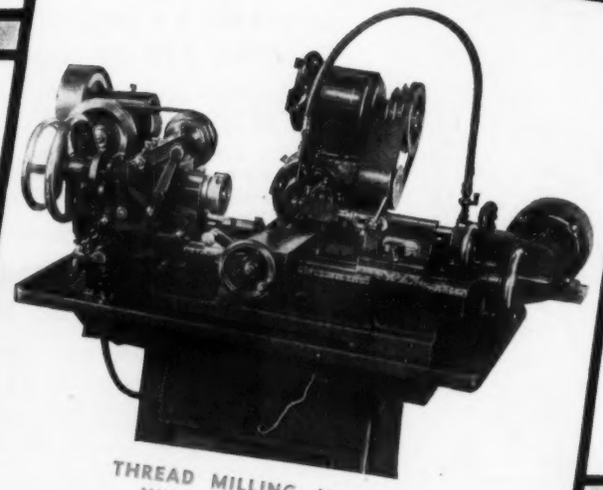
WALTHAM SUB PRESSES

Waltham Cylindrical Sub Presses supplied with suitable dies can be depended on to turn out work of uniformly high quality and precision. Because clean quality stampings are assured at all times, use of this equipment assures big savings in time and money.

Sturdy, rigid construction and perfect alignment of parts assures maintained accuracy even on long runs. Easy adjustment for wear makes it a simple matter to maintain close fit. Either overhang or arch type can be supplied.

Investigate Waltham Sub Presses as a means of stepping up your production through their ability to turn out parts ready for assembly.

Ask for details.



THREAD MILLING MACHINE WITH 3 MOTOR DRIVE

WALTHAM THREAD MILLERS

Precision thread milling on a production basis is assured by modern floor type Waltham Thread Millers.

Modern in every detail, these machines are remarkably versatile in the wide range of work they can handle. They are ideal machines for both tool room and production requirements.

These machines will mill precision threads of standard forms such as V, N.S., Whitworth, Buttress, etc., conveniently, quickly and accurately. Cutters for these forms can be supplied.

The three motor drive (speed, feed and oil) recently adopted adds rigidity to the cutter head and increases the speed range. Taper and compensating attachments can be supplied also a motor driven internal cutter head of improved design.

WALTHAM MACHINE WORKS

WALTHAM MASS. ▼

for MAXIMUM CAPACITY IN MINIMUM SPACE

Interchangeable

WITH SINGLE-ROW BALL BEARINGS

NORMA-HOFFMANN

PRECISION ROLLER BEARINGS

NORMA-HOFFMANN BEARINGS CORP'N.,

STAMFORD, CONN., U. S. A. • *Founded in 1911.*

Write for the Catalog. Let our engineers work with you.

Their solid cylindrical rollers provide maximum contact area, giving larger load and shock-absorbing capacity than any other single-row bearing of like dimensions. Thus, when NORMA-HOFFMANN PRECISION ROLLER BEARINGS are used in place of ball bearings, a greater factor of safety is provided, together with added life, particularly under vibration and overload. PRECISION qualities in workmanship and materials adapt them alike for both low and high speeds.

Speed up production

"HANSON" PROCESS

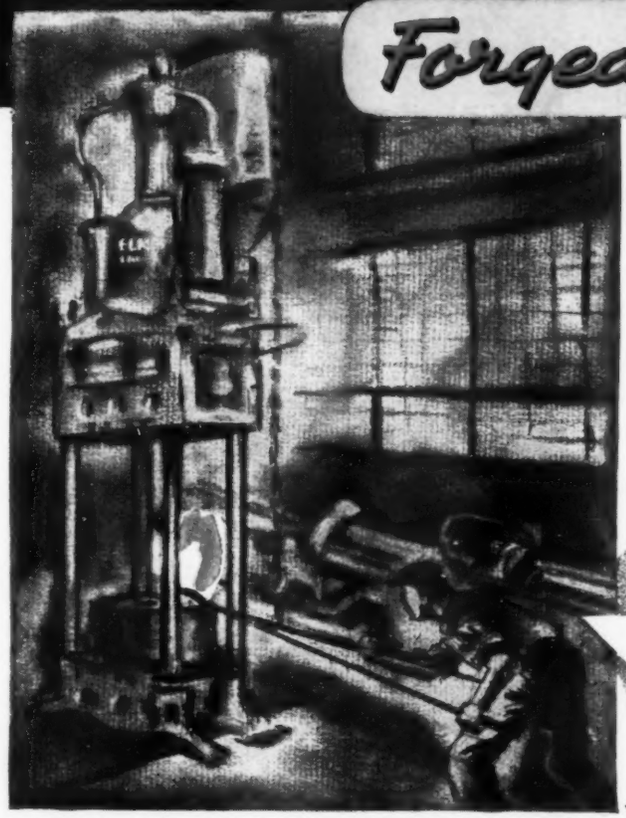
LOOK FOR THIS EMBLEM

H-W Taps deliver long, accurate runs between grinds . . . minimize down time and reduce rejects. And H-W Taps retain precision longer . . . because the "Hanson Process," our exclusive method of finishing after hardening, insures uniform grain structure from tip to shank. Speed up production by looking for the "Hanson Process" Emblem on the taps you buy. For more detailed information please write.

The HANSON WHITNEY MACHINE CO

HARTFORD CONN., U.S.A.

Forged on Presses



Victory shells, large and small, are being forged and nosed on hydraulic presses built by Elmes . . . Moreover, Elmes presses are turning out parts for guns, ships, planes, tanks and other war equipment. The Elmes line of hydraulic machinery and equipment is complete . . . including forging presses, forming and drawing presses, plastic molding presses, straightening and bending machines, accumulators, pumps, valves and accessories. Since 1851 this organization has been gaining experience in the design and manufacture of precision equipment . . . which experience today is available to users of hydraulic installations.

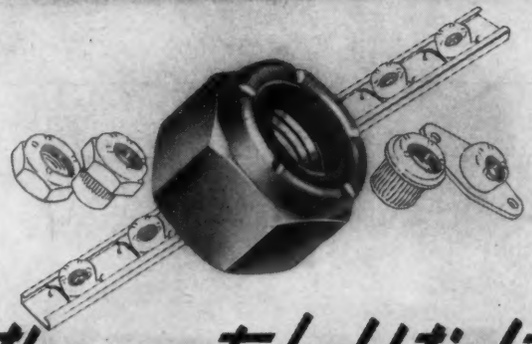
CHARLES F. ELMES ENGINEERING WORKS
1001 Fulton Street • *Since 1851* • Chicago, Illinois
Also Manufactured in Canada • WILLIAMS & WILSON, LTD., *Distributors*

Built by ELMES

METAL WORKING PRESSES • PLASTIC MOLDING PRESSES • PUMPS
EXTRUSION PRESSES • ACCUMULATORS • VALVES • ACCESSORIES

The Boeing B-17 Flying Fortress is fastened throughout, at important structural and secondary connections, with Elastic Stop Nuts.

WHEN THE BIG TEST COMES



these nuts hold tight

Bolted connections on military airplanes call for lock nuts that hold with a grip which is positive and yet resilient . . . a grip that withstands the complex vibrations, the stresses, and the shocks, of high-speed maneuvering . . . a grip that protects the ships and the men who fly in them.

Evidence that Elastic Stop Nuts meet these all-important requirements is found in the fact that they are used for vital structural and equipment fastenings on *every* military airplane built in the Western Hemisphere.

There are more Elastic Stop Nuts on American airplanes, tanks, and other war equipment, than all other lock nuts combined.

THE RED LOCKING COLLAR
. . . SYMBOL OF SECURITY

ELASTIC STOP NUT CORPORATION
2351 VAUXHALL ROAD • UNION, NEW JERSEY

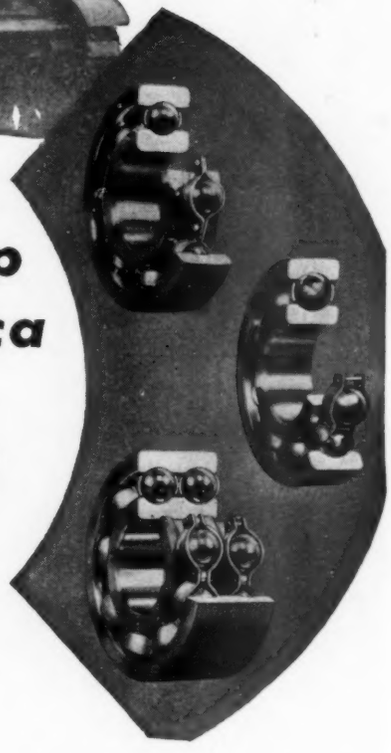
Elastic Stop SELF-LOCKING NUTS AND AIRCRAFT FITTINGS

HELP AMERICA KEEP 'EM FLYING!

» Catalog will be sent on request
. . . and nuts for testing are readily available.

Prepared and Determined

to Help America ROLL Ahead



MACHINES and vehicles of war depend on ball bearings for efficient operation. Providing "smooth rolling" for the armed forces and for industries vital to victory is now the all-out job at BCA.

BCA is proud to share in the achievement that has made the ball bearings industry a bright spot in wartime manufacture. BCA is prepared... BCA is determined...to help the nation push uphill to the necessary record breaking production peak.

BEARINGS COMPANY OF AMERICA, LANCASTER, PENNA.

Standardize on Standard Sizes

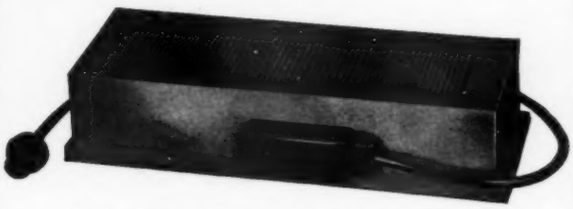
BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

Walker Rotary Magnetic chuck with Concentric Gap—Style D—Face Plate — Walker Rotary Chucks are made in sizes from 4" to 72" diameter with Face Plate construction adapted to the work to be held.

STEP UP WAR PRODUCTION by saving set-up time with WALKER MAGNETIC CHUCKS*



Walker No. 617 Bar Pole Face Rectangular Magnetic Chuck, for holding small thin work. Sizes range from 6"x10" to 12"x60".

Walker Universal Swivelling Magnetic Chuck sizes 4"x10", 4"x20" and 4"x30"—can be arranged with Vernier Reading.

Walker No. 618 Rectangular Magnetic Chuck—available in sizes from 4"x8" to 30"x96".

WALKER DEMAGNETIZERS

These units are available from Walker in standard D.C. and A.C. types for 110 or 220 V service. They provide a fast and convenient means of removing residual magnetism from a wide variety of parts. Send for Circular K7 giving detailed information.

•

Because of their ability to hold work securely under heavy cuts, Walker Magnetic Chucks fit into the demand for high production of war materials. Then, too, these dependable units contribute to more and better work in less time.

Of proved design and utmost dependability, Walker Magnetic Chucks in Rectangular and Rotary Types help speed up grinding, milling, planing and turning operations. Standard units are available for practically any chucking need. A complete range of sizes makes it possible to select exactly the right Walker for your problem. Magnetic chucks for special requirements can be furnished in reasonably short time.

Come to Walker for magnetic chucks and you'll save time and speed up war production.

Write for catalog No. W4 giving complete information

O. S. WALKER CO., Inc.
Worcester, Mass., U.S.A.

There is No Contact Maintenance with this Solenoid Motor Starter

Yes sir! You can have simple and reliable motor control and at the same time do away with contact maintenance by standardizing on Allen-Bradley solenoid starters and relays.

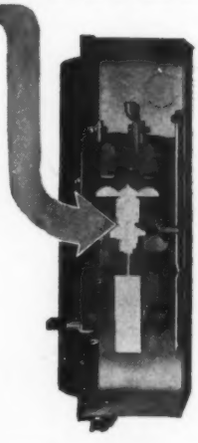
This solenoid starter has no pivots, pins, hinges, or flexible jumpers. There is no complicated mechanism. The movable contacts, mounted directly on the solenoid plunger, open and close with quick, positive action. There are no bearings to corrode, no jumpers to break, no parts requiring adjustment. Every feature of Allen-Bradley solenoid starters has been designed for simplicity and reliability—that's why they're good for millions of trouble-free operations.

Contact maintenance has been eliminated. The patented silver alloy contacts never need cleaning, filing, or dressing. There are no flashovers—contacts never weld. For longer life—and less trouble and worry—specify Allen-Bradley solenoid motor control.

Only ONE MOVING PART

Allen-Bradley solenoid starters are extremely simple. Only one part moves. This reduces the possibility of trouble and increases operating life. No other starter has so few moving and wearing parts. All pins, pivots, bearings, and hinges have been eliminated. Because of the double-break contacts, there are no flexible jumpers.

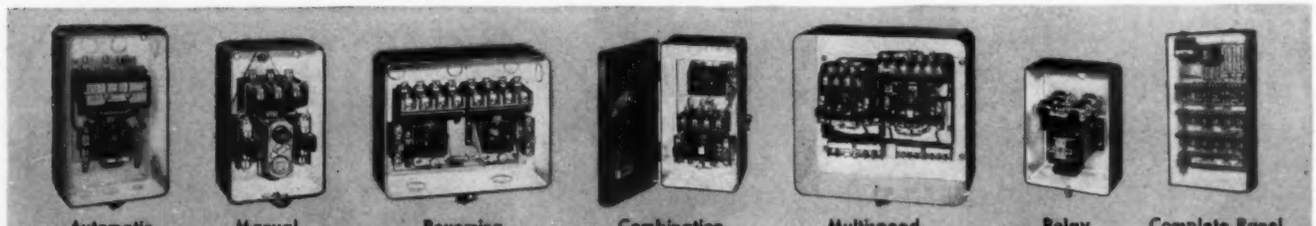
To lower your maintenance costs, insist on Allen-Bradley solenoid starters. They are simple, compact, rugged, easy to install, and easy to maintain.



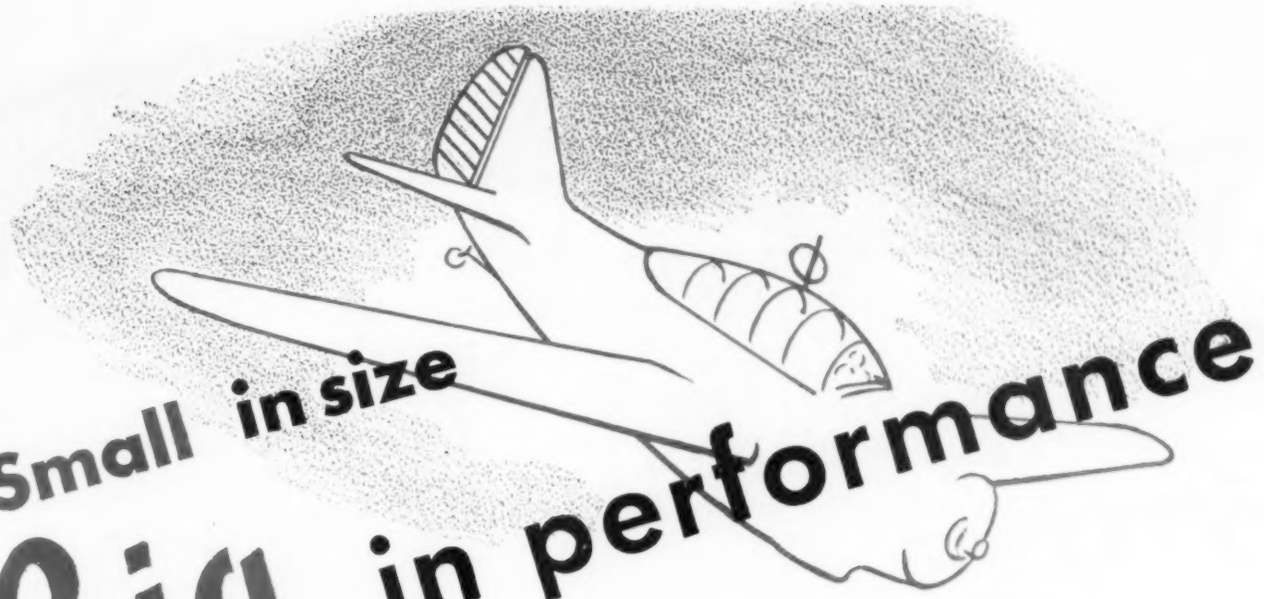
Allen-Bradley Company

1310 S. Second St.
Milwaukee, Wis.

ALLEN-BRADLEY SOLENOID MOTOR CONTROL



THERE IS A STANDARD ALLEN-BRADLEY CONTROL FOR EVERY INDUSTRIAL APPLICATION



Small in size
Big in performance

. . . so are

DALZEN

• VERTICAL •

THREAD GRINDERS

Today airplanes and machine tools have this in common — *they're fighting machines!* Dalzen Vertical Thread Grinders are as especially designed and built for their work as fighting airplanes . . . they pack tremendous performance in small space. They give you wide range capacity, greater accuracy and increased production in little more than *half the space* formerly required for grinding threads. They not only save space — they make more floor space for added equipment or the more efficient arrangement of your production line.

That's not the whole story—but it's one angle of the vital importance of putting Dalzens to work for you. Look over the specifications here — then write us for Bulletins.

Dalzen Tool & Mfg. Co., 12255 E. 8 Mile Road, Detroit, Mich.

Note — We also make the Dalzen Combination Center Lapping Machine and Drill Press . . . does the work of 2 machines in the space of one!

No. 2 above—43″ wide, 39″ deep, 72″ high—grinds threads to 4″ long anywhere on an 8″ shaft, diameters up to 3″.

No. 1—48″ wide, 38″ deep, 75″ high —grinds threads to 10″ long anywhere on an 18″ shaft, diameters up to 6″.

DALZEN

Do much more • take less floor

THE SPARKS SEMI-AUTOMATIC HYDRA-FEED LATHE

is built for speed and maintained accuracy in shell production . .

ROUGH TURNS 155 m/m SHELL IN 69 SECONDS

Ample power and convenient tooling for fast, accurate shell production are combined in the SPARKS LATHE. On the rough turning operation shown here, seven (7) tools are used. At a cutting speed of 310 ft. per min., with a depth of cut from 5/16" to 1/2" and a feed of .054", a 155 m/m shell is rough turned in 69 seconds.

OPERATION IS AUTOMATIC

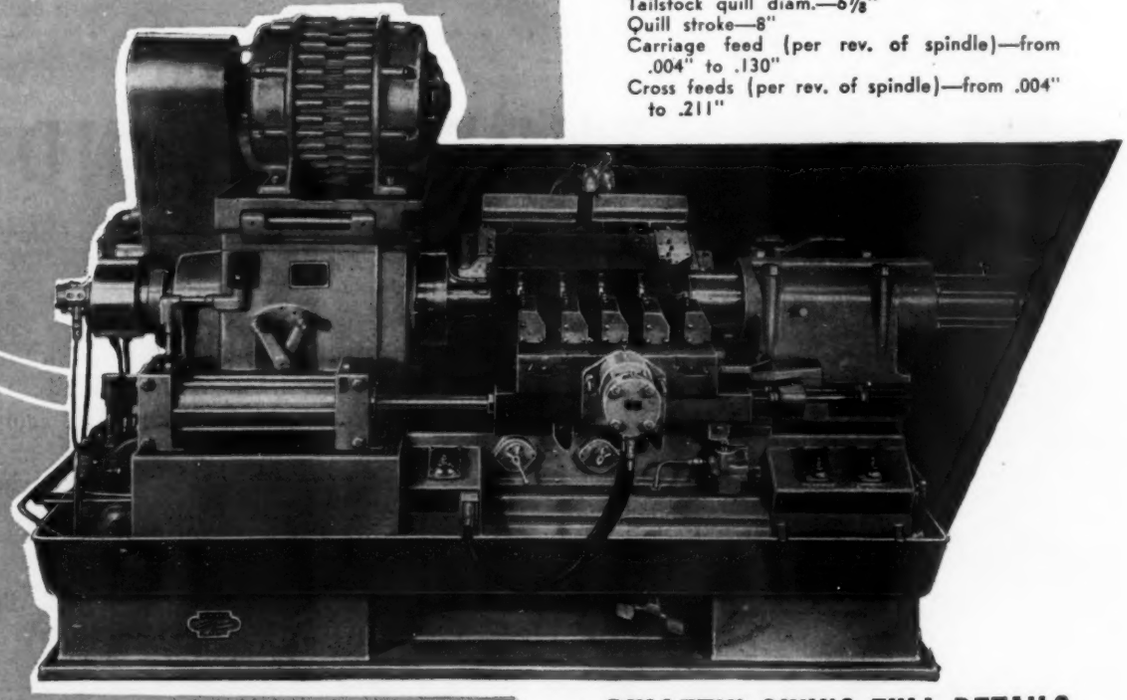
The SPARKS LATHE is equipped for automatic operation through the use of hydraulic power feeds and hydraulically operated duplex brake and clutch for starting and stopping spindle. All movements of the carriage are provided with automatic stops; hydraulic and automatic stop movements are provided to cross slide; spindle chuck or expanding arbor are also hydraulically operated.

The SPARKS LATHE is also equipped with roller bearing revolving tail stock spindle, motor driven coolant pump, pan and tank. Complete electrical control equipment is provided with proper size motors for each size of shell.

This lathe will handle rough and finish turning of all sizes of shell bodies from 75 m/m to 8" inclusive.

CONDENSED SPECIFICATIONS

Swing over ways—21"
Swing over carriage—12"
Extreme distance chuck to tail center—33" and 45"
Length of bed—7' 6" and 8' 6"
4 speed Timkenized selective geared headstock
Hole through spindle—2"
Tailstock quill diam.—6⅞"
Quill stroke—8"
Carriage feed (per rev. of spindle)—from .004" to .130"
Cross feeds (per rev. of spindle)—from .004" to .211"



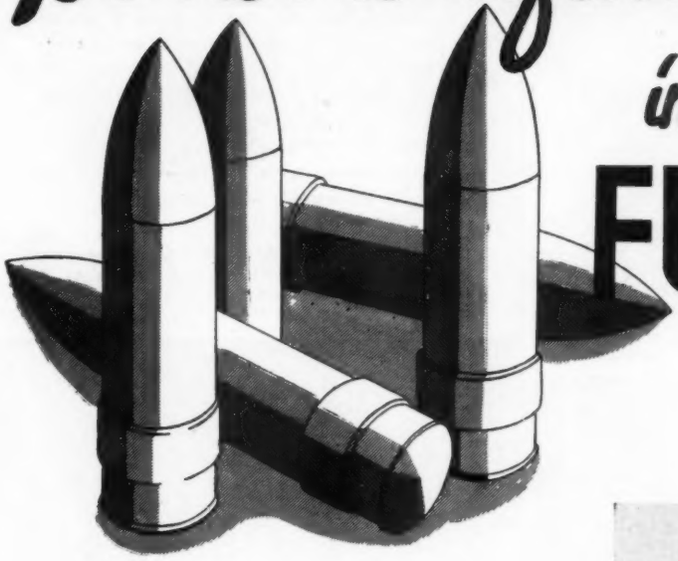
★ **BULLETIN GIVING FULL DETAILS AVAILABLE ON REQUEST**

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

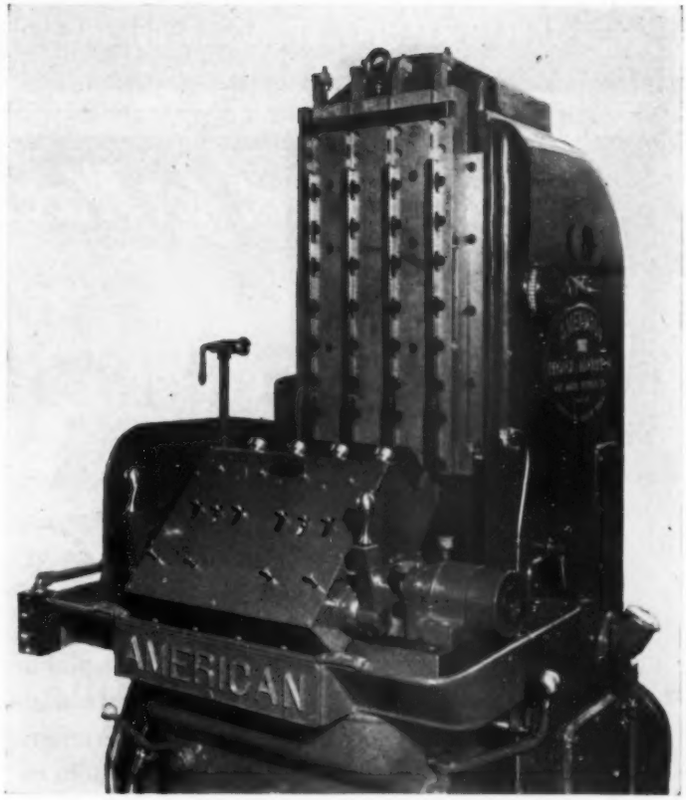
AMERICAN

Points to defense



in BROACHING FUSE PARTS

War production of shells has been increased by the use of "AMERICAN" broaching equipment. The photograph at the right shows the operation on an "AMERICAN" T-6-32 Threeway type vertical hydraulic broaching machine arranged for surface broaching end and slot on magazine fuse cap. The material of the part is bronze and the operator loads four parts simultaneously one at each station. The operator clamps the two L.H. parts with L.H. lever and the two R.H. parts with R.H. lever. Operator then presses foot pedal which controls air valve arranged to tilt fixture into broaching position and starts machine on cutting stroke. At end of broaching stroke, the fixture automatically tilts back to loading or unloading position, at the same time the four parts are unclamped to facilitate manual removal. The fixture is again loaded during the return stroke of main ram and the cycle is duplicated. High production is obtained.

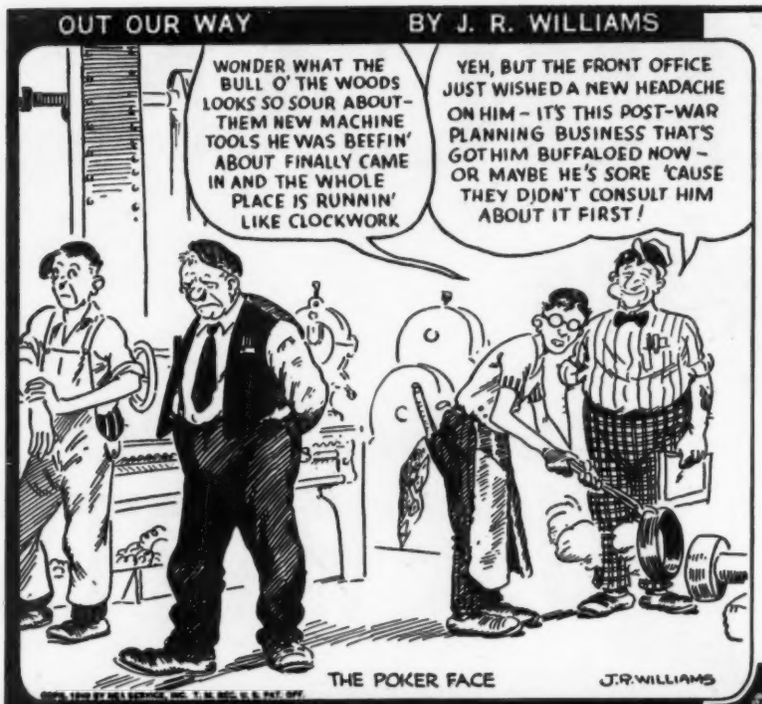


AMERICAN BROACH & MACHINE COMPANY

ANN ARBOR, MICHIGAN, U. S. A.

BROACHING MACHINES, PRESSES, BROACHING TOOLS, SPECIAL MACHINERY

Division of SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

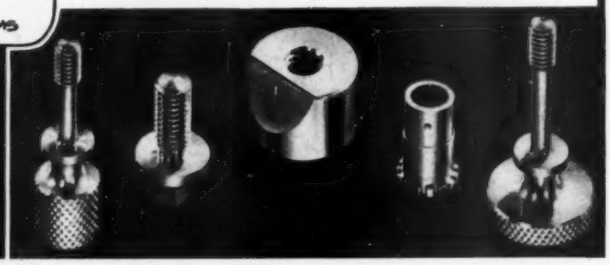

OUT OUR WAY
BY J. R. WILLIAMS
WONDER WHAT THE BULL O' THE WOODS LOOKS SO SOUR ABOUT— THEM NEW MACHINE TOOLS HE WAS BEEFIN' ABOUT FINALLY CAME IN AND THE WHOLE PLACE IS RUNNIN' LIKE CLOCKWORK
YEH, BUT THE FRONT OFFICE JUST WISHED A NEW HEADACHE ON HIM — IT'S THIS POST-WAR PLANNING BUSINESS THAT'S GOT HIM BUFFALOED NOW — OR MAYBE HE'S SORE 'CAUSE THEY DIDN'T CONSULT HIM ABOUT IT FIRST!
THE POKER FACE
J.R.WILLIAMS

We Sympathize with the 'Old Bull'...

ALL of us have our hands full today. Our every facility, our fullest efforts, are focused on one goal—victory! That is our first job—our big job. However, as we drive ahead in this all-out war production effort, we believe it wise to keep an eye on the future...to plan now wherever possible for the problems of post-war production. If you agree with this thinking, we will be happy to talk over this vital subject with you...and together set our sights for the day when peace will be won.

(*Below*) These are a few of the many thousands of our precision-made parts that help "Keep 'em flying."

ERICSSON ESTABLISHED 1911



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SCREW MACHINE PRODUCTS CO., INC.

25 LAFAYETTE STREET, BROOKLYN, N. Y.

Specialized for War Production Speed-up

TURCO

Industrial CHEMICAL COMPOUNDS

This is war! And every bit of information which will help to speed up War Production is being shared by manufacturers to promote the common cause toward victory. Turco Products, Inc., is gladly contributing information which will help to speed up production in almost every division in your plant. There is a complete line of Turco Specialized Industrial Chemical Compounds for all of the operations listed on coupon at right. Check the list; mail to us for free information and literature. No obligation.

CHECK THIS LIST AND MAIL FOR INFORMATION

TURCO PRODUCTS, INC., 6135 S. Central Ave., Los Angeles

Please send me FREE literature on materials, methods and procedure pertaining to the operations checked below:

NAME_____ TITLE_____

FIRM_____

ADDRESS_____ STATE_____

I'M INTERESTED IN THE OPERATIONS WHICH I HAVE CHECKED (✓):

- ☐ Acid Pickling
- ☐ Aluminum Spot Welding
- ☐ Anodizing
- ☐ Cadmium Plating
- ☐ Chemical Vapor Cleaning
- ☐ Chromatizing
- ☐ Cleaning Metals Before Processing
- ☐ Cleaning Prior to Plating
- ☐ Cold Immersion Cleaning
- ☐ Cold Spray Cleaning
- ☐ Floor Maintenance
- ☐ General Plant Maintenance
- ☐ Glass Cleaning
- ☐ Hot Immersion Cleaning
- ☐ Magnesium Processing
- ☐ Paint Camouflage Cleaning
- ☐ Paint Dept. Maintenance
- ☐ Paint Stripping
- ☐ Phosphatizing
- ☐ Scale Removal and Control
- ☐ Stainless Steel Processing
- ☐ Steam Boiler Maintenance

I-72

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FACTORIES IN LOS ANGELES AND CHICAGO

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Head Office: 6135 S. Central Ave., Los Angeles

SALES AND SERVICE REPRESENTATIVES AND WAREHOUSE STOCKS IN ALL PRINCIPAL CITIES

HOW PLATING SERVES in the War effort!

Electroplated finishes are serving the war effort in countless ways . . . on ordnance equipment and supplies, aircraft parts and accessories, and a long list of other war materiel. Plating is also being used wherever the functional purpose of an essential article can be served in no other way — or where plating makes possible the saving of larger weights of critical materials.

In addition, plated finishes are making important contributions to the production and processing of many essential products. Take chromium plating for example. There are many applications where this process saves vital materials and man-hours in the fabrication of metals. We have prepared a helpful booklet on this subject entitled "The Last Thousandth of an Inch that Speeds Production" which points the way to further possibilities for chromium plating in war industries. A copy is yours for the asking.

How UNITED CHROMIUM can help you!

THE PLATING PLANT has an important role in the war effort . . . in meeting the needs of our military departments, in utilizing available electroplating facilities, in getting the most out of materials and equipment.

But the problems involved in applying electroplated finishes to war purposes are many and complex. The United Chromium organization is devoting its time and effort to the solution of these problems . . . and its engineering service is available to hundreds of licensees, whether in connection with chromium plating or the Unichrome* Alkaline Copper process with its valuable characteristics in meeting today's plating requirements.

3 WAYS United Chromium can help you:

SPEED CONVERSION! U. C. supervisory assistance helps licensees to get their installations into prompt and efficient war production.

MEET SPECIFICATIONS! In serving hundreds of licensees, we have had wide experience in the operating cycles, solution control and plating techniques required for work to strict standards.

CONSERVE MATERIALS! U. C. processes, production materials and technical assistance avoid waste of essential metals.

Our Service Engineers are ready to help you. An inquiry outlining your problem to any office below will bring prompt and specific recommendations on how the U. C. processes and advisory service can help you.

*Trade Mark Reg. U. S. Patent Office

UNITED CHROMIUM
INCORPORATED

51 East 42nd Street
New York, N. Y.

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2751 E. Jefferson Ave.
Detroit, Mich.

Waterbury, Conn.

—and thanks for keeping that promise! *

Honest delivery promises are mighty important these days — when time counts for so much in war production — when schedules *must* be met! P&H knows this. And P&H has done something about it!

*Despite the largest volumes in our entire 58-year history, we're beating *our* schedules — to help vital war plants beat *theirs*. P&H guarantees delivery dates within ± 3%.

To save time, effort — and make the most of man power — handle it "thru the air" with P&H Hoists. Built in capacities up to 15 tons, P&H Hevi-Lift Hoists are the proper solution to hundreds of materials handling problems. P&H engineers are ready to help you.

• *Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.*

P&H HEVI-LIFT HOISTS

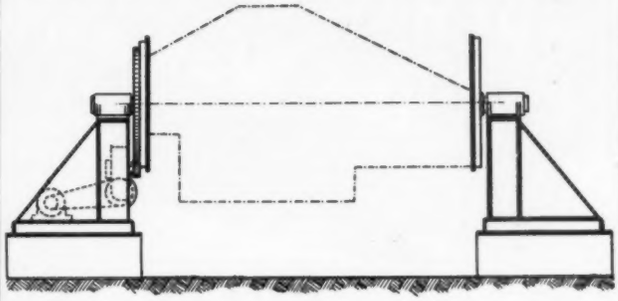
Gen. Offices: 4514 W. National Ave., Milwaukee, Wis.

HARNISCHFEGER CORPORATION

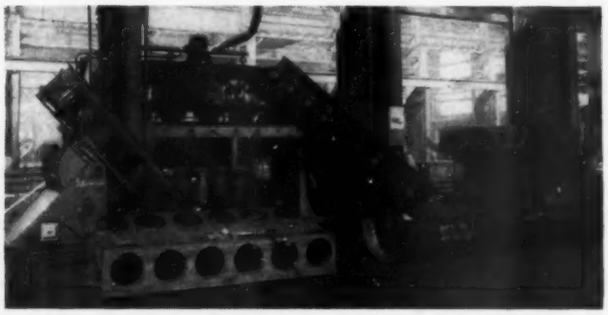
HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

From Motor Cars to Munitions

Ransome Welding Positioners PLAY A VITAL ROLE



Ransome standard motor-operated Head-stock and Tail-stock Unit. The tail-stock is located to accommodate objects of various lengths. Sub-bases are provided to meet height requirements.



Three 8 ton units handling Diesel Engine crankcases. Positioners also used for other heavy complicated products.

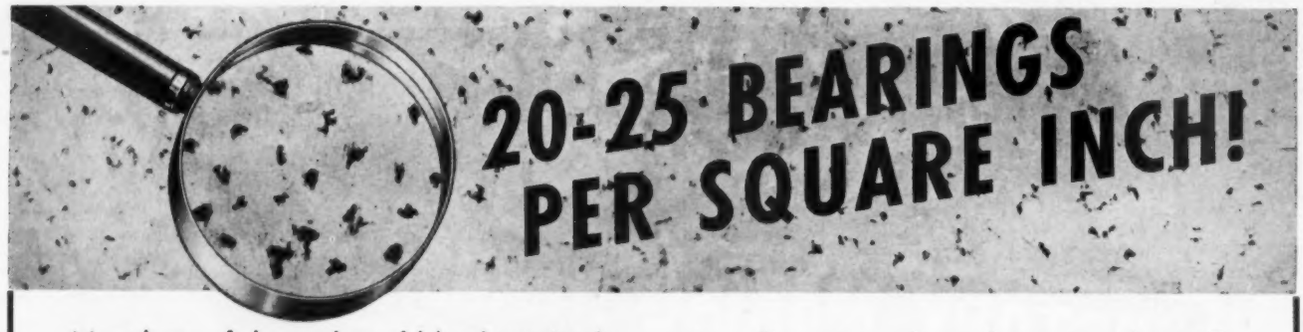
Typical of the work many Ransome Positioners are handling is that shown above which is a sub-assembly for a unit used by one of the armed forces.

Write for Bulletin 200M
INDUSTRIAL DIVISION

RANSOME CONCRETE MACHINERY CO.

DUNELLEN NEW JERSEY

Motorcar Industry's Biggest Job Is Mass Production of Bombers
By David J. Wilkie.
Studebaker Plants Speeding War Work
HISTORY MAKING HEADLINES
Ford Turns Out First of Big 4-Motor Ships
Detroit, May 21.—(AP)—The first of the Big Four engined bombers which soon will be put into mass production based on automobile manufacturing methods has rolled off the new half mile long assembly line of the 37
Detroit Concerns On War Schedul
Big Motor Plants Producing Guns, Engines, Boats
GENERAL MOTORS DOUBLES OUTPUT
Turns Out War Supplies At Increasing Rate, Hunt Declares.
General Motors Speeds War, Material Shipments
New York, May 18.—(AP)—General Motors Corporation estimated today it had delivered $112,000,000
PLANE FACTORY NEARLY FINISHED
Ford to Apply Mass Production Methods to War Aircraft.
THOMAS R. HENRY.
Shipments of War Goods Reveal Sharp Increase
New York, April 13.—(AP)—General Motors Corporation today reported its shipment of war products in the first quarter this year amounted to $261,084,959.
Doubling of Peace-time Volume Seen by G. M
DETROIT, May 21
"LOGAN"
HELPED IN CONVERTING THIS GREAT INDUSTRY
Motor Cars to Munitions — the greatest conversion job the world has ever known. The success of this undertaking is being told daily in the press. But before these accomplishments there is another story. A story of re-building — re-equipping — re-tooling. "LOGAN" Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories are helping to make these production records possible. Throughout the automobile industry "LOGAN" Equipment is playing a vital part in obtaining the ultimate production goal. "LOGAN" Representatives and "LOGAN" Engineers will be glad to make recommendations on your production problems.
LOGANSPORT MACHINE, INCORPORATED
918 PAYSON ROAD
LOGANSPORT, INDIANA
Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories.



20-25 BEARINGS PER SQUARE INCH!

Many hours of slow and careful hand-scraping by craftsmen on Lombard Surface plates produce this exceptional high degree of precision.

Designed for use where extreme surface accuracy is required, these plates are made of high-grade close-grained, semi-steel type iron, especially heat-treated to relieve casting and machining stress. Every stage of manufacture is under rigidly supervised control.

The construction is extra rigid, with heavy ribbing and three point suspension to maintain extreme accuracy indefinitely. Compare, size for size, the weight of Lombard surface plates with others.

Angle plates,
V Blocks,
Parallels
also available.

WRITE FOR DETAILS AND PRICES

SCRAPED SURFACE PLATES

Standard Sizes Available for Prompt Delivery

SIZE (Inches)	WT. Approx. in Lbs.
14 x 18	95
18 x 24	190
24 x 24	295
24 x 36	450
24 x 48	900
48 x 48	1700
60 x 72	4850

LOMBARD GOVERNOR CORPORATION
200 MAIN ST. ASHLAND, MASS. U. S. A.

Write for complete, detailed information on "Buzzer" Industrial Gas Equipment.

BUZZER

INDUSTRIAL GAS FURNACES

NO BLOWER OR POWER NECESSARY

ASSURE FAST HEATING TO HIGHER TEMPERATURES

1650 Degrees in 1 Hr. 15 Min. in ATMOSPHERIC POT FURNACES

Buzzer Pot Hardening Furnaces are tangentially fired and require no extra equipment such as blowers, boosters or power.

Heating time from cold to 1650 degrees for a popular brand of salt is 1 Hr. 15 Min. average.

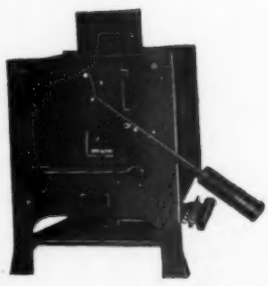
Require low initial investment and operate at low fuel cost; easy to control.

Adaptable to melting zinc, aluminum and lead. Made in various sizes.

2400° in 1½ Hrs. in "SUPER HEAT" HIGH SPEED MUFFLE FURNACES

These furnaces offer protective atmospheres, quiet operation, low fuel consumption and flexibility of control. They are ideal for heat treating high speed and alloy steels. Ready for operation by connecting to gas supply. Ruggedly constructed and efficiently insulated.

Made in several sizes.

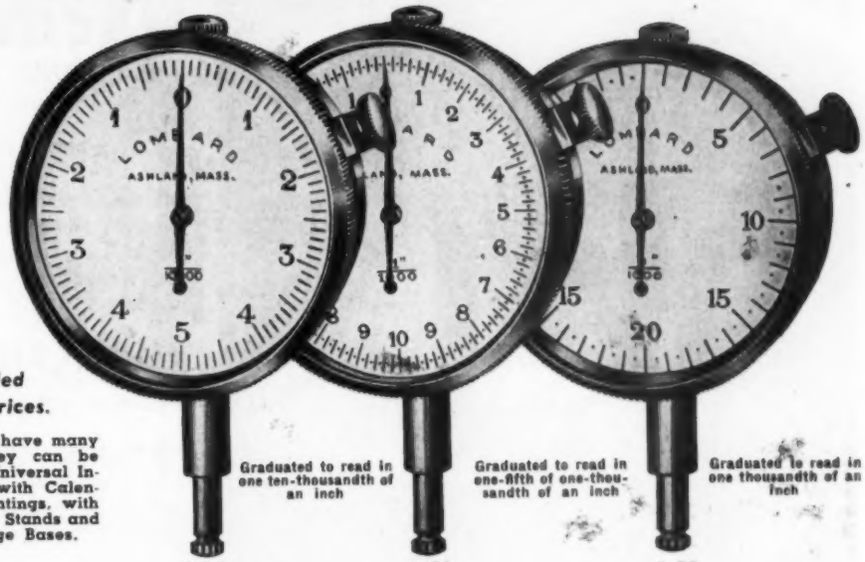


CHARLES A. HONES INC., 121 So. Grand Ave., Baldwin, N. Y.

LOMBARD DIAL GAUGES

The fine Lombard standard of craftsmanship is inherent in these "A" type indicators, ruggedly constructed to give long, accurate service. Brass gears and cases are used throughout. The spindles are of stainless steel. Solid front and back plates applied directly to the case eliminate need for dowels and assure longer gauge life and accurate repeat readings. Furnished with lug back as standard, but plain back will be supplied if desired. Illustrations ¾ actual size.

Write for detailed information and prices.



Graduated to read in one ten-thousandth of an inch — A-10

Graduated to read in one-fifth of one-thousandth of an inch — A-20

Graduated to read in one thousandth of an inch — A-30

These indicators have many applications. They can be furnished with Universal Indicator Stands, with Calendar Gauge Mountings, with Thickness Gauge Stands and with Depth Gauge Bases.

Lombard Junior Gauge

Designed for use on small fixtures (1¼" Dial. Reads to half thousandths

A-J-5

LOMBARD GOVERNOR CORPORATION

ASHLAND, MASSACHUSETTS, U. S. A.

MATERIAL saved in machine-construction and assembly goes to make *more* machines, more armament. Help *shield*— *CONSERVE*— our production-resources by reducing weight and bulk of machine parts.

ALLEN Hollow Screws help *materially.* They permit the use of lighter parts with no loss of capacity to hold. They require less stock for flanges, lugs, all projections for screw fastenings.

The greater *strength* of Allen screws allows *smaller* screws to be used. Their internally-engaging hex keys require less room for wrench movement in setting-up. The keys themselves are the most metal-saving form of wrench.

These small savings — *in millions of places* — bulk large in the war economy and proportionately in yours.

Call on your local Allen Distributor to expedite your orders to the very utmost under present stock-shortages.

THE ALLEN MANUFACTURING COMPANY

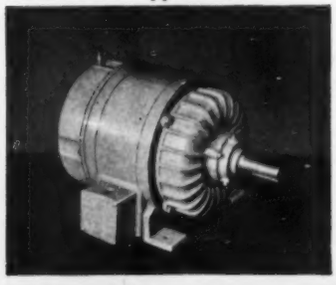
HARTFORD, CONNECTICUT, U. S. A

CONVERSION SIMPLIFIED by TORQ-QUA-MATIC DRIVES in 4 WAYS

1. TORQ-QUA-MATICS permit re-arrangement of machines without regard to existing overhead shafting:
2. Provides 4 output speeds of sufficient range to permit the use of any type cutting tools, including carbide:
3. TORQ-QUA-MATICS make possible the use of old machines otherwise not suited to war time production schedules:
4. TORQ-QUA-MATICS are easy to order and quickly installed.

Equipment can be ready for operation in two hours or less. When the time comes to convert back, you will find your TORQ-QUA-MATICS are still capable of many more years of profitable operation. TORQ-QUA-MATIC Drives are not makeshifts:—they are, instead, precision built Drives, carefully designed, built to give maximum trouble-free service—with hardened gears and shafts of special alloy steel, anti-friction bearings, complete oil sealage and splash lubrication. You can depend on them for the stamina and long life required for 24 hours a day high tempo production schedules.

TORQ-QUA-MATIC Drives can be delivered promptly, for any machine tool application.



NO DRIVE IS BETTER THAN ITS MOTOR

TORQ Motors are designed and built for the heavy duty performance on TORQ-QUA-MATICS. Totally enclosed, fan cooled, their steel frame gives complete protection against accidental blows. All parts of TORQ Motors are precision built, and are completely interchangeable. TORQ-QUA-MATIC Drives come equipped with TORQ Motors ranging in size from 1 to 15 H. P. Literature will gladly be sent upon request.

THE TORQ ELECTRIC MFG. COMPANY
6603 CARNEGIE AVENUE · CLEVELAND, OHIO

Increased Production

means more jobs for

MACHINISTS

—and MORE PAY for men who know their work

This big home-study and reference course gives you the practical facts on machines and methods you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency with

AMERICAN MACHINISTS' LIBRARY

6 volumes, 2516 pages, 2368 illustrations, many charts and tables

THESE books answer your questions on methods and machines—tell what you need to know about the operation of machines of all types and sizes for the whole range of metal cutting, forming, and finishing operations—show by text, diagram, and illustration the essential points of setting up work, adjusting machines, selecting feeds and speeds, determining pressures, handling materials, devising short-cuts, etc.

Puts the mastery of machine-shop work at your fingertips

With these books at hand for quick reference, no job is too hard or unusual, and the routine jobs may be improved, with savings in time and trouble and reduced wastage.

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—complete guide for everybody, from shop executive to apprentices, interested in the operation of machines used in turning and boring practice

—description of all important varieties of machines, both manual and automatic, and methods of operating them

—data on speeds and feeds, new cutting alloys and materials, use of coolants, etc.

—practical information on grinding machines and abrasive wheels, showing what they do, how to operate them, and how to make best use of them on various types of work.

—training in the various operations performed in drilling and surfacing materials in the machine shop

—exact, descriptive data on all aspects of gear-cutting practice, useful in shops of any size

—essentials of selecting machines, setting up work, and handling operations in reaming, tapping, planing, shaping, slotting, milling, and broaching

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Send me the American Machinists' Library, 6 volumes, charges prepaid, for 10 days' Examination. If I find the books satisfactory, I will send you $1.50 in 10 days, and $3.00 a month until the special price of $19.50 has been paid. Otherwise I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

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Company .....A. 6-11-42

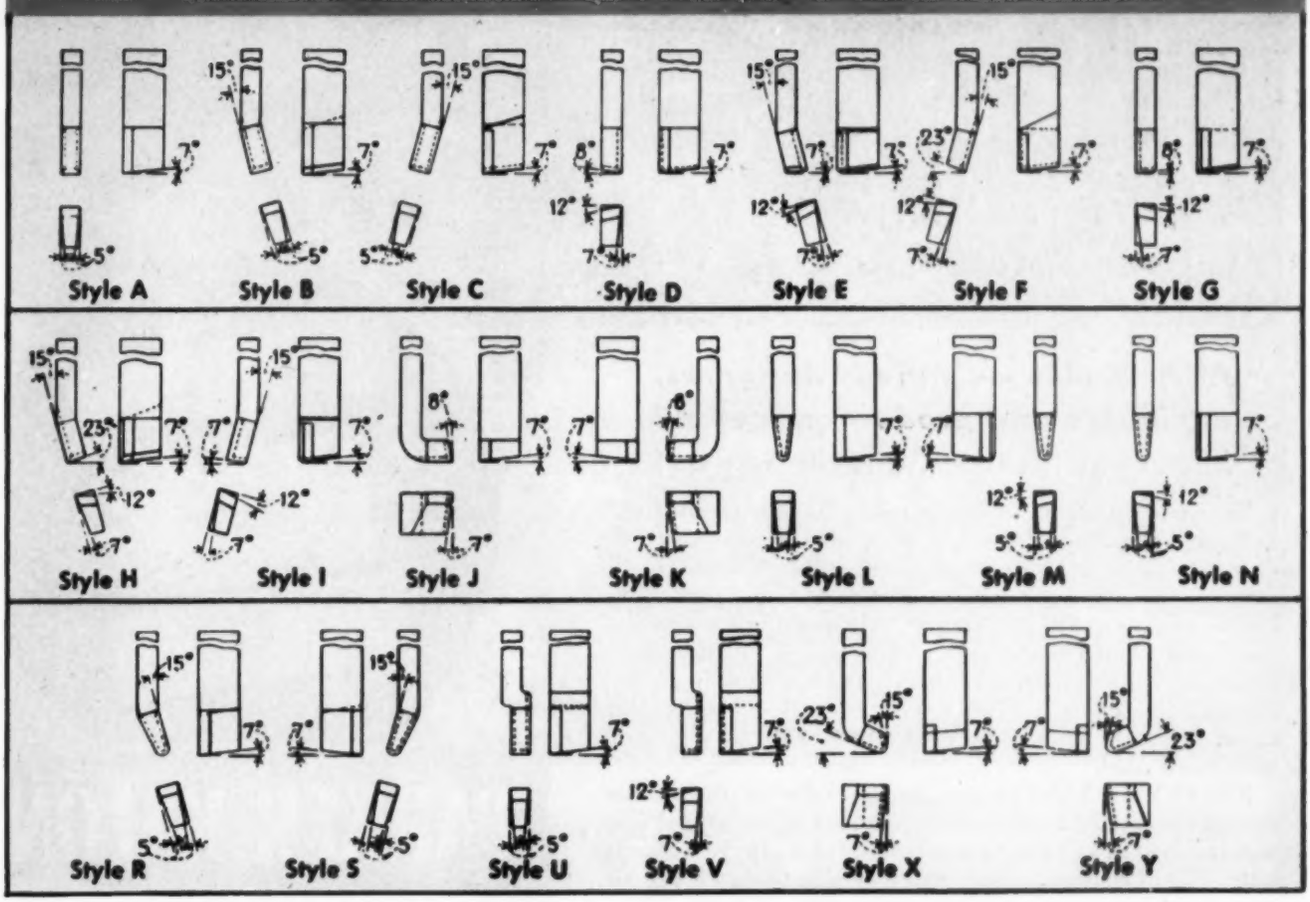
Immediate Deliveries . . . Lower Tool Costs
Use HAYNES STELLITE Standard Welded Tip Tools

YOU can take full advantage of the high production properties of Haynes Stellite cutting tools by using the many available styles and sizes of standard welded tip tools. These tools consist of a cutting tip of cast Haynes Stellite alloy welded to a tough steel shank. They can be used where solid bits are impracticable . . . and can perform any standard turning, facing or boring operation at low cost per piece machined . . . The sizes and styles shown in the table are carried in stock for immediate delivery. Others can be made to order to users' specifications.

SIZES OF HAYNES STELLITE STANDARD WELDED TIP TOOLS

Tool Sizes, inches	*Tool Styles*
½ x 1 x 7	ABCDEF
⅝ x 1 x 7	AD
⅝ x 1¼ x 8	ABCDEFGIKLMRSUVXY
¾ x 1½ x 9	ABCDEFGLMUV
⅞ x 1¾ x 9	A
1 x 1 x 7	ADGN
1 x 1¼ x 7	ABDGJKLMNRSXY
1 x 1½ x 10	ADUV
1 x 2 x 12	ADG
1¼ x 1¼ x 7	ADGJKLMNRSXY

STYLES OF HAYNES STELLITE STANDARD WELDED TIP TOOLS



SOLID square and flat Haynes Stellite tool bits, and solid milling cutter blades are available for immediate delivery in a wide range of standard sizes. You can also obtain many special tools, such as brazed-in blade milling cutters, spot facers, and core drills; blades for boring and reaming; grooving, cutting-off, and forming tools. Complete information on request.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Indiana

District Offices: Chicago, Cleveland, Detroit, Houston, Los Angeles, New York, San Francisco, Tulsa.

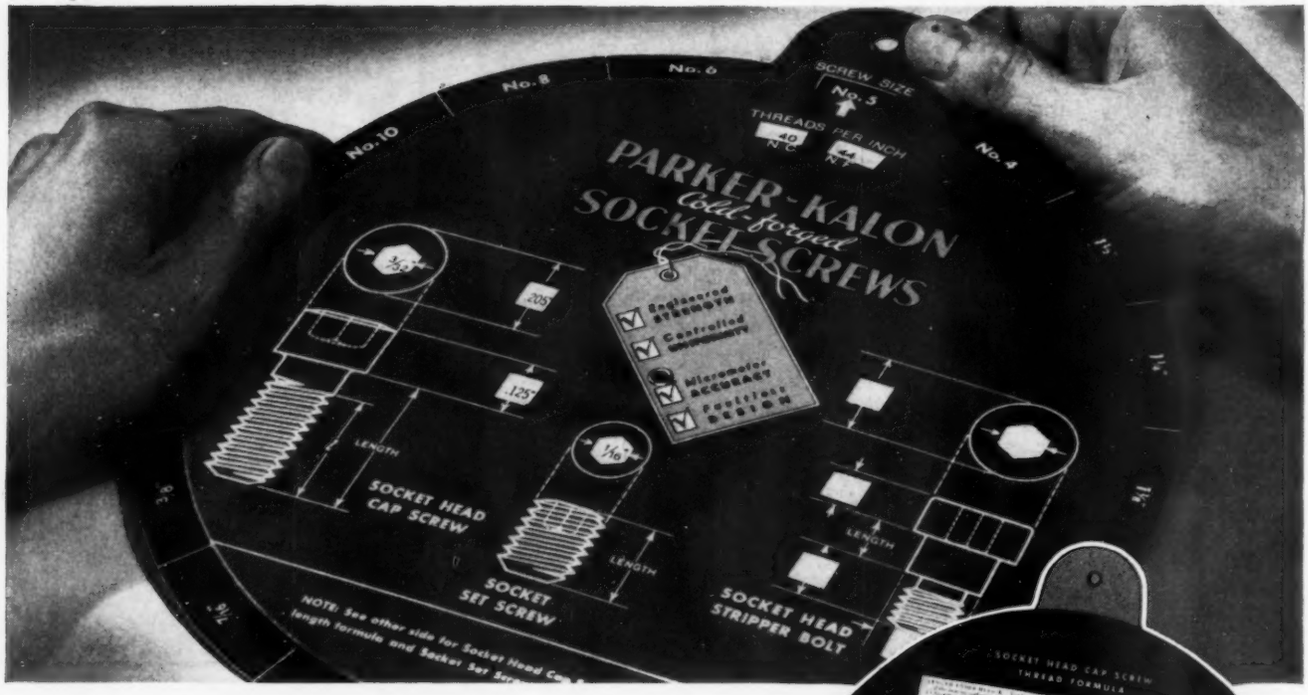
HAYNES STELLITE

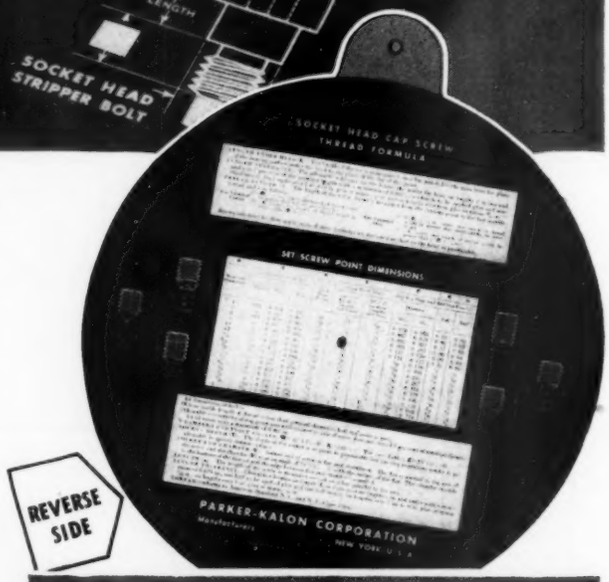
Red-hard, wear-resisting alloys of cobalt, chromium and tungsten

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

Free! SOCKET SCREW DIMENSION FINDER

that will help you speed up work!





REVERSE SIDE

At A Glance -- it gives designers, engineers and production men all important data on Socket Screws!

This unique chart will save you precious minutes and annoyance. A turn of the dial brings before you, in large, easy-to-read figures, all the important dimensions of the standard sizes of Socket Head Cap Screws, Stripper Bolts and Set Screws. On the reverse side you have a table of Set Screw Point Dimensions . . . Cap Screw Thread-length Formula . . . and other useful data. Ten inches in diameter, bright in color, this Finder won't get "lost" on a busy table. Hang it on your wall or drafting board by the metal reinforced hole.

SUPPLY IS LIMITED . . . so this offer of the Finder must be restricted to designers, engineers, drafting and production men in key positions who ask for a copy at an early date. Fill in coupon . . . and please be sure to attach to your company's letterhead.

PARKER-KALON CORP., 194-196 VARICK ST., NEW YORK, N. Y.
Please send the Parker-Kalon Socket Screw Dimension Finder.

Name ..... Position .....
Company .....
Address .....
Make of Socket Screw we use .....

PARKER-KALON
Quality-Controlled
SOCKET SCREWS
Give the Green Light to Defense Assemblies

Carrying the Battle

● In today's war of land, air, and sea-going machines the outcome of an engagement may hinge upon the operation of a single part.

● Good parts are the product of good tools. National Cutting Tools are tools of *character*, built for hard use, long life, exacting precision.

NATIONAL

NATIONAL TWIST DRILL & TOOL CO. DETROIT U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS

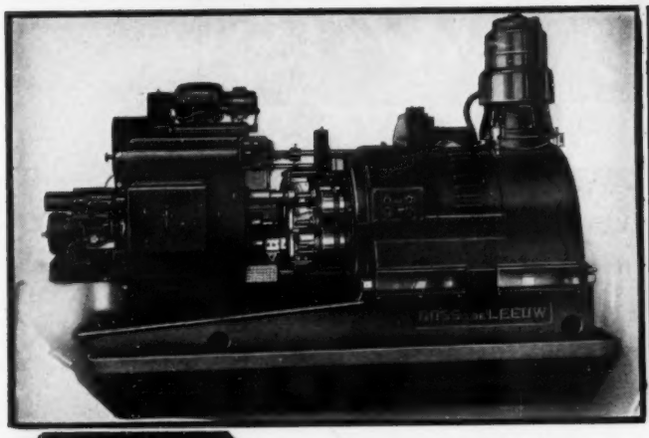
TWIST DRILL AND TOOL COMPANY

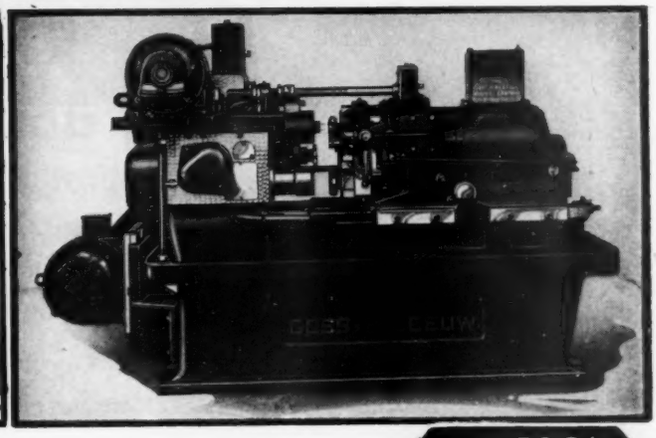
HOME OFFICE AND FACTORY—DETROIT, MICH.

Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES





WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

Features include:

Lead Screw Threading on both types—Pre-loaded Anti Friction Spindle Bearings—Hardened Ways—Oversize Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

MAC-IT
Quality Steel Screws
In some applications, regular cap screws may not provide the desired holding power or margin of safety.
Mac-it hex head cap screws, milled from the bar and heat treated, have the strength needed for these extra tough jobs.
OTHER MAC-IT PRODUCTS INCLUDE:
Socket Head Cap Screws • Hollow Set Screws • Square Head Set Screws • Stripper Bolts • Hexagon Socket Pipe Plugs
THE STRONG, CARLISLE & HAMMOND COMPANY
1392 West Third St., Cleveland · Ohio

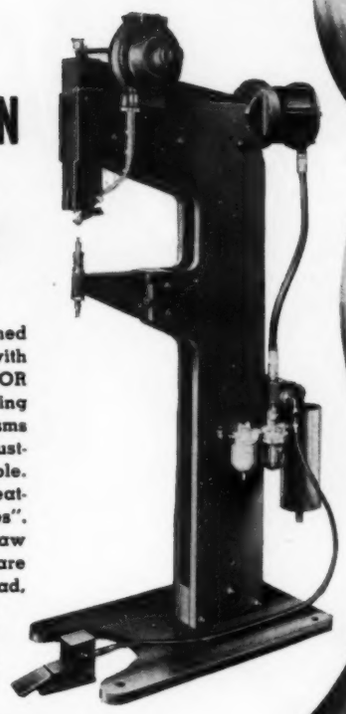
TOMKINS-JOHNSON

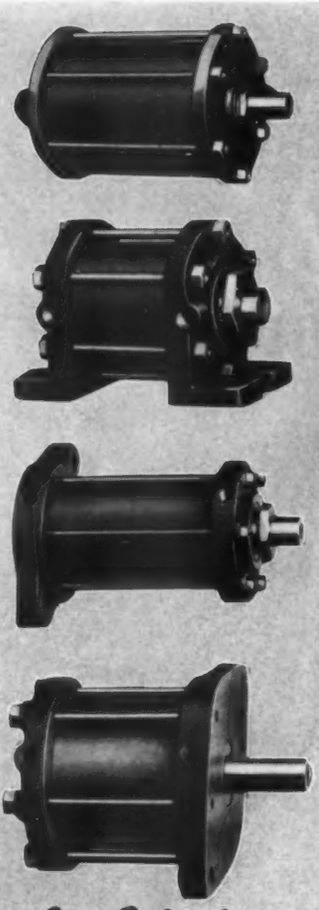
Air Powered

RIVITOR

(for aircraft production)

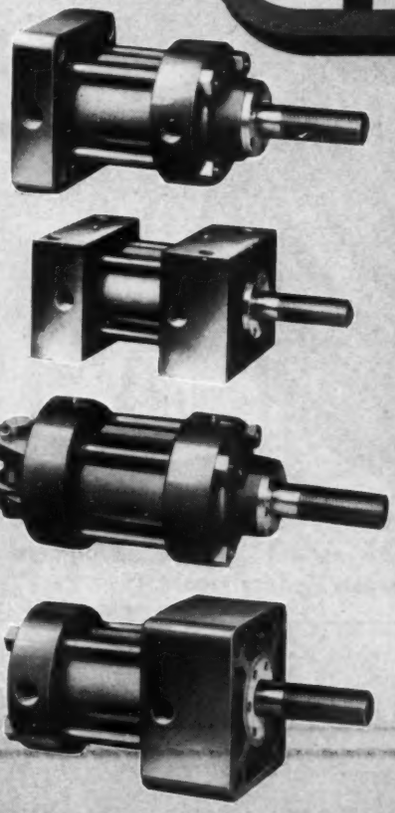
Furnishes "air squeeze" action combined with automatic feed riveting. In keeping with established T-J quality, this new RIVITOR contains many cost-cutting, efficiency building features — feeding and setting mechanisms are automatic . . . setting tools are adjustable . . . horn section is interchangeable. Steel side plates, base plate and non-repeating foot pedal operations, are other "pluses". By using a different type rivet set and jaw construction, Counter Sunk Head rivets are handled, as well as Flat Head, Round Head, Full and Semi-Brazier Head Rivets. This high production T-J Air Powered Rivitor is your best choice for work within its range . . . write for production data, prices and deliveries, address to Dept. A.





Air Cylinders

T-J



Hydraulic Cylinders

EQUIPMENT

HELPS ATTAIN MAXIMUM SPEED IN PRODUCTION!

Increased performance and machine efficiency, plus greater handling convenience, are a few of the many advantages T-J products bring to machines and equipment engaged in today's high pressure defense production requirements.

T-J products . . . air and hydraulic cylinders . . . are easily and quickly installed . . . they become an integral part of the machine to which they are applied.

T-J AIR CYLINDERS

These units exert power movement from 100 lbs. to 12,000 lbs. (direct). Made in styles, sizes and strokes to meet your requirements.

T-J HYDRAULIC CYLINDERS

Designed and furnished in types and sizes to exert power movement from 1,000 lbs. to 50,000 lbs. (direct). Available to meet your specifications.

Our engineers are eager to help you step up production through the application of T-J products. Consult with them, regarding your requirements. Write for detailed data, address to Dept. A.

THE TOMKINS-JOHNSON CO.

Jackson . . . Michigan

HEADS OR TAILS—

You win!

UNBRAKO

Self-Locking

HOLLOW SET SCREWS

Tails you win *Holding Power*—famous characteristic of "Unbrako" Self-Lockers with the knurled points! Set them up with no more than average pressure and they automatically lock into place—stay gripped regardless of vibration. Saves maintenance costs, helps to prevent costly breakdowns and delays. Easy to apply or remove and you can use them repeatedly.

Next time you order, be sure to specify "UNBRAKO" *Self-Lockers.*

UNBRAKO

Reg. U. S. Pat. Off.

famous for years as the

KNURLED SOCKET HEAD CAP SCREW

with no premium price!

Heads you win a definite speed-up on the assembly line or wherever cap screws are used. The "Unbrako" *knurling* gears right to the fingers . . . prevents annoying, time-wasting finger slip . . . permits faster and farther turning of the screw before applying wrench!

Because of this time-saving advantage, and because the knurling also permits quick and easy locking of the screw after countersinking, many plants are now standardizing on *Knurled* "UNBRAKO" exclusively. Make your next order *Knurled* "UNBRAKO" too!

Knurling of socket screws originated with "Unbrako" years ago.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA. BOX 4

—— BRANCHES ——

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

use

RACINE HIGH SPEED SHEAR-CUT SAWS

Over 6,000 pounds of compact sawing machinery—designed and armored to cut the heaviest loads and toughest alloys twenty-four hours a day—are represented in RACINE Heavy Duty Hydraulic Saws with automatic bar feed. Made in four different capacities, 10" x 10", 12" x 12", 10" x 16" and 12" x 16" they easily handle bars in any standard length and loads up to 4,000 pounds.

This is real automatic sawing: Identical pieces from long bars and tubes are hydraulically measured and cut off in any desired length from 1/64" to 54". Setting a single pointer on a graduated scale gives you accurate cut lengths and the setting of a graduated dial gives you the correct cutting feed for the size of bundle and type of material being cut. There is no guess work and your material is smoothly handled-quickly cut off by positive oil-cushioned hydraulic power. Simple rugged fool proof design that inexperienced hands can operate and maintain highest production standards.

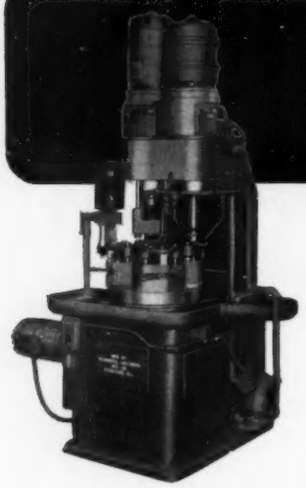
Write today for catalog #80-B or for information on any of RACINE'S full line of modern metal cutting saws—from general purpose utility type machines in 6" x 6" capacity to production models in 6" x 6" to 14" x 20".

RACINE TOOL AND MACHINE CO.

1752 STATE STREET RACINE, WIS.

Standard the World Over

Rehnberg-Jacobson
ORDNANCE MACHINES



SHOT CAP MACHINE

This four-position, two-spindle vertical machine performs the finishing operations on 37 mm. A.P. Shot Caps. The first spindle completely finishes the top profile of the cap, including the point and undercut, with an inserted-blade hollow milling tool. The second spindle automatically threads the cap, using a chaser-type die head with a precision ground lead screw.

180 PER HR.

Capacity of this machine is 180 pieces per hour, requiring one operator to load and unload the work at the two front stations. Proper synchronization of operations is obtained with electric interlock. Illustration shows unfinished and finished cap.

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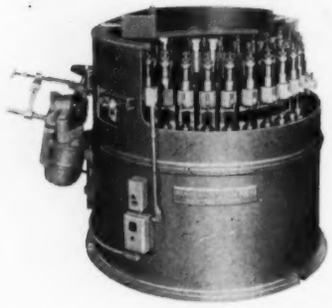
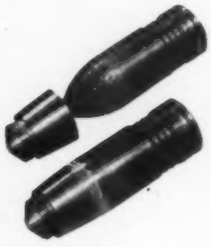


SOLDER WIPING MACHINE

This machine assembles shot and cap with a wiped solder joint, excess solder being removed by a brush. Operation is continuous and automatic, the wiping action providing a firm joint with exclusion of all air bubbles and oxidation. The machine requires about six feet by seven feet of floor space and has two motors totalling 5 horsepower.

1200 PER HR.

Capacity of this machine is 1200 assemblies per hour. Three operators are required —one to load the shot, one to load the cap, and one to remove the completed assemblies. Illustration shows the cap and shot separate, and the assembled unit.



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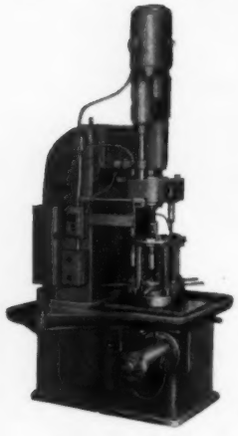


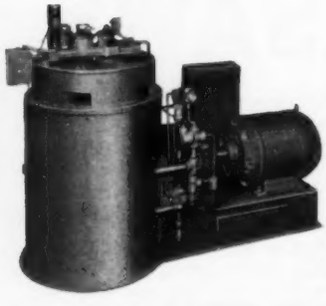
TRACER HOLE MACHINE

This is a five-station, vertical, automatic-indexing machine for drilling, reaming, and countersinking the tracer hole in 75, 57, 40, or 37 mm. A.P. shot. The sequence of operations is (1) Unload and load, (2) Drill half way, (3) Drill from half way to depth, (4) Ream to depth, and (5) Countersink. The drilling is done in two steps to increase production and reduce drill breakage and wear. The reaming spindle has individual feed to give it twice the travel of the drilling spindles. One machine can, with minor modifications in the fixtures, be used for any of the four sizes of shot listed above.

240 PER HR.

Capacity of this machine is 240 holes per hour. One operator is required, to load and unload the work. All operations are fully automatic and electrically interlocked for protection. Illustration shows a 75 mm. shot before and after the tracer hole is drilled.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★



SHELL BANDING MACHINE

This machine squeezes the band onto the shot and will handle shot from 20 mm. to 75 mm. size at various production rates depending on the number of squeezes necessary to give a thorough penetration of the band into the serrations. When more than one squeeze is used, the piece is indexed between squeezes to permit uniform metal flow and prevent crystallization. Pressure can be regulated to suit a variety of conditions.

600-1200 PER HR.

Capacity of this machine is 1200 20 mm. shot or 600 37 mm. shot per hour. One operator is required, to drop the shot and band into the "nest". Illustration shows shot and band, and the assembly.

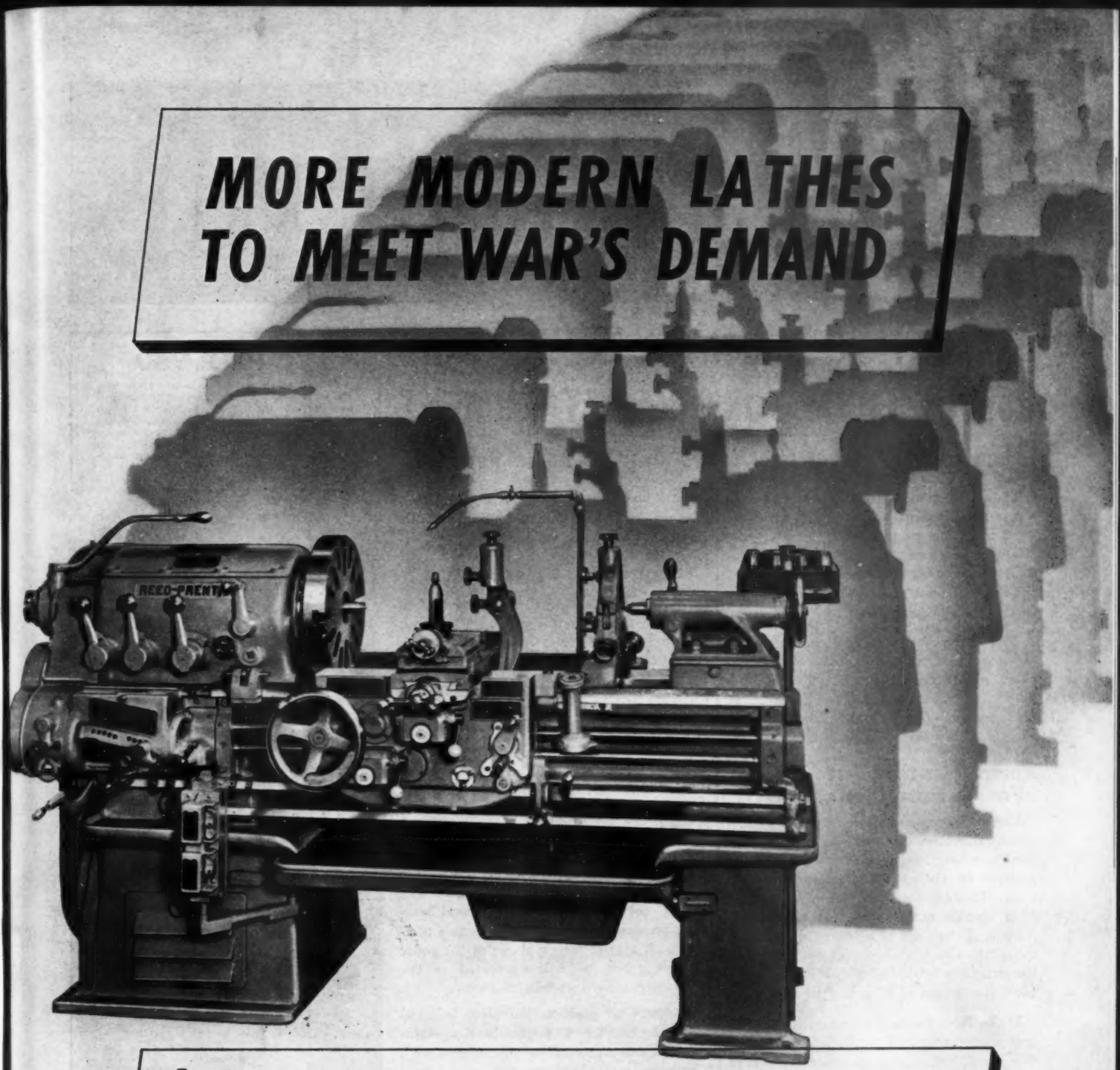
REHNBERG-JACOBSON MANUFACTURING CO.

Special Machinery

2137 KISHWAUKEE ST. ROCKFORD, ILLINOIS

REHNBERG R-J JACOBSON

MORE MODERN LATHES TO MEET WAR'S DEMAND



EVERY DAY, more Reed-Prentice lathes and milling machines are coming off the production line to take their places in the Victory effort. In the munitions plants, airplane plants, tank and transport plants — everywhere on the home front — Reed-Prentice equipment is doing its rugged share for ultimate victory.

On board our ships of war, Reed-Prentice lathes are helping to maintain our fighting equipment throughout the world.

Day and Night production continues with more to come. Over 55,000 square feet of additional assembly space is under construction. Reed-Prentice Corporation, Reed-Prentice workmen, Reed-Prentice Machine Tools are doing their share.

REED-PRENTICE CORPORATION

213 W. 3d. ST., CLEVELAND **WORCESTER, MASS., U. S. A.** 75 WEST ST. NEW YORK

Greenlee AUTOMATIC NEWS

PREPARED BY GREENLEE BROS. & CO., ROCKFORD, ILL.

PRODUCTION OF BOLT SPEEDED UP BY USE OF FORM TURNING ATTACHMENT

Greenlee 1⅝" Automatic Turns Out 36 Parts Per Hour

Today the manufacturer using automatic screw machines in the production of the vital munition parts needed for our war effort, can be sure of getting maximum production from his machines by using only the most efficient tooling set up possible for each particular job.

This story of the production, on a 1⅝" Six-spindle Greenlee Automatic Screw Machine, of a connecting rod bolt for an airplane engine, is an excellent example of planning the most efficient tooling to obtain the greatest production possible.

Form Turning Attachment For Turning Long Length

The problem encountered in the production of this connecting rod bolt was that of turning a long length in as few positions as possible to obtain the maximum production. To solve this production problem, a form turning attachment was used which permitted the part to be completely rough turned in two positions and still maintain the short stroke of 1⅛ inches necessary to get a production of 36 pieces per hour.

If the form turning attachment had not been incorporated in the tooling set-up for this part, the production would have been considerably less than it was, since a longer tool slide stroke would have been required to permit the rough and finish turning operations that the finish of this part required.

Production Time Cycle 100 Seconds

The production time cycle for this connecting rod bolt, made from 11/16" square A.M.S. 6310 steel is 100 seconds, or 36 per hour. The spindle speed is 166 R.P.M., resulting in 42 S.F.M. The tool slide feed is .0042 inches per revolution.

Sequence of Operations

In the first position the stock is broken down for the form turning operation, and the thread diameter is rough turned with the roller turner.

In the second position the square section is turned with the form turning attachment, the thread diameter is finish turned, and the end is faced.

In the third position the piece is rough formed under the head, the .365 front bearing diameter is finish turned, and the end is chamfered for the thread.

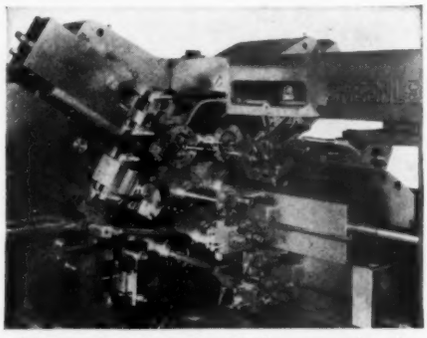
In the fourth position the relief section in back of the thread and the tapered section of the front bearing diameter is formed. The second relief diameter and the second bearing diameter are rough turned in this position with a knee turner ahead of the roller support. The piece is supported on the previously turned thread diameter.

In the fifth position the piece is faced under the head, and the rear bearing diameter and the rear relief diameter are formed. The piece is again supported on the previously turned thread diameter.

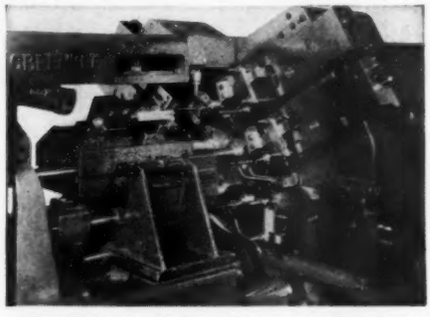
In the sixth position the piece is supported and then cut off.

TO HELP YOU

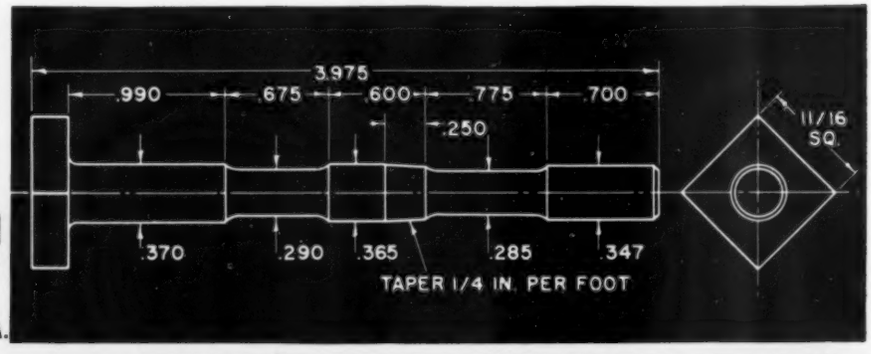
Greenlee Bros. & Co. hopes that the performance data and production stories of jobs now being run on Greenlee Machines presented in these advertisements will be of some help to the metal-working industry in obtaining more efficient screw machine production.



Shown above is a view of the set-up for the production of this part, showing the first, second, and third positions. The photograph was taken just after the machine was indexed and does not show completed operations at the various positions. The form turning attachment described in this story is shown in the second position.

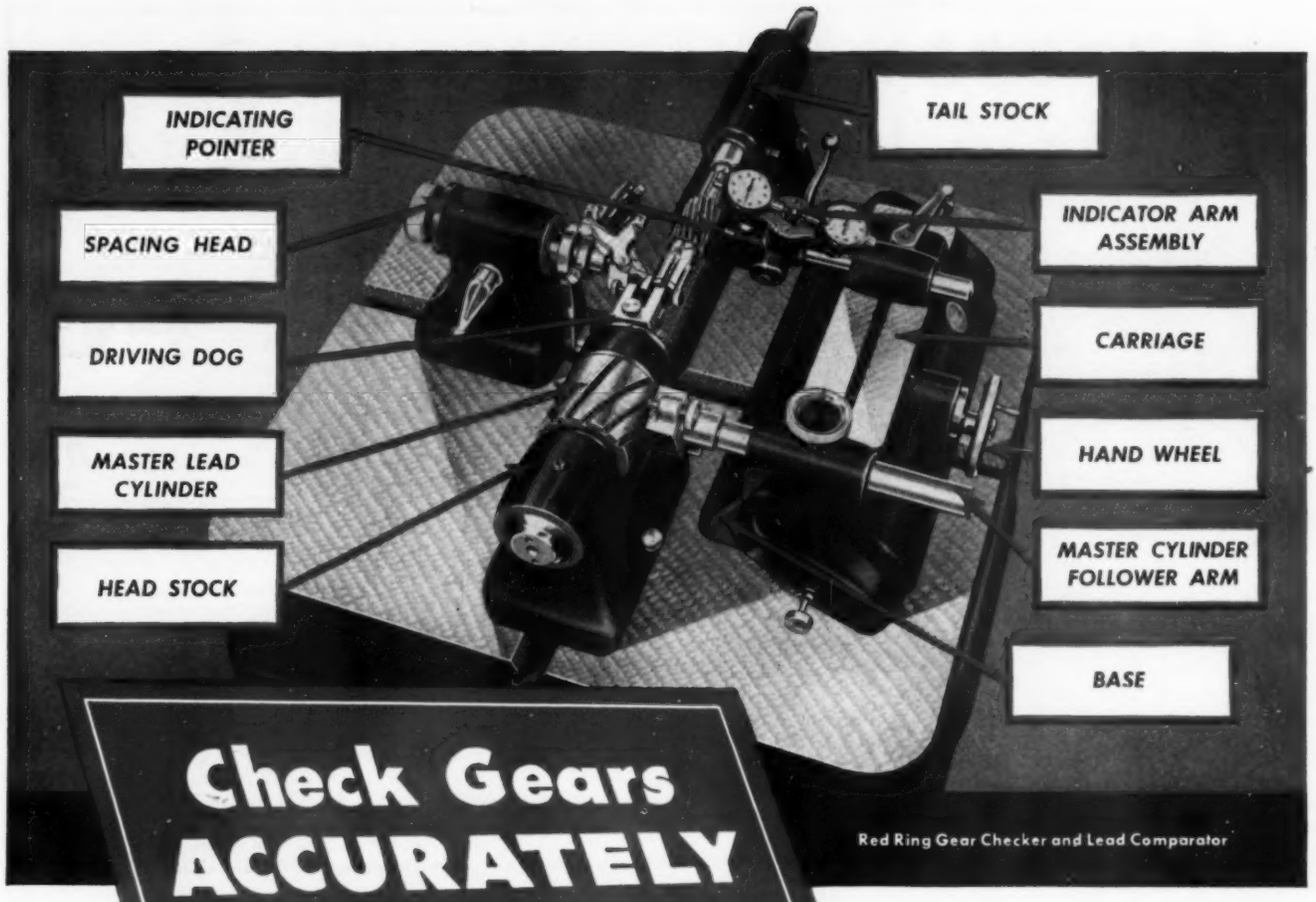


The photograph shown here was taken from the rear of the machine and shows the tooling set-up for this job in the fourth, fifth, and sixth positions.



Greenlee BROS. & CO.
ROCKFORD ILLINOIS U.S.A.

MULTIPLE-SPINDLE DRILLING, BORING, AND TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AIRCRAFT PRODUCTION MACHINERY



Red Ring Gear Checker and Lead Comparator

Check Gears ACCURATELY and QUICKLY

Checks spur, helical and internal gears with or without integral shaft

●

Determines index, interference, helix angle, wobble, eccentricity and tooth size—also the lead of helical gears

●

Readings to .0001"

Typical small gears may be checked in less than one minute

●

Operator needs no special skill or training to inspect gears on a production basis

●

Lead is checked against a hardened and ground master lead groove

Write for descriptive literature

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

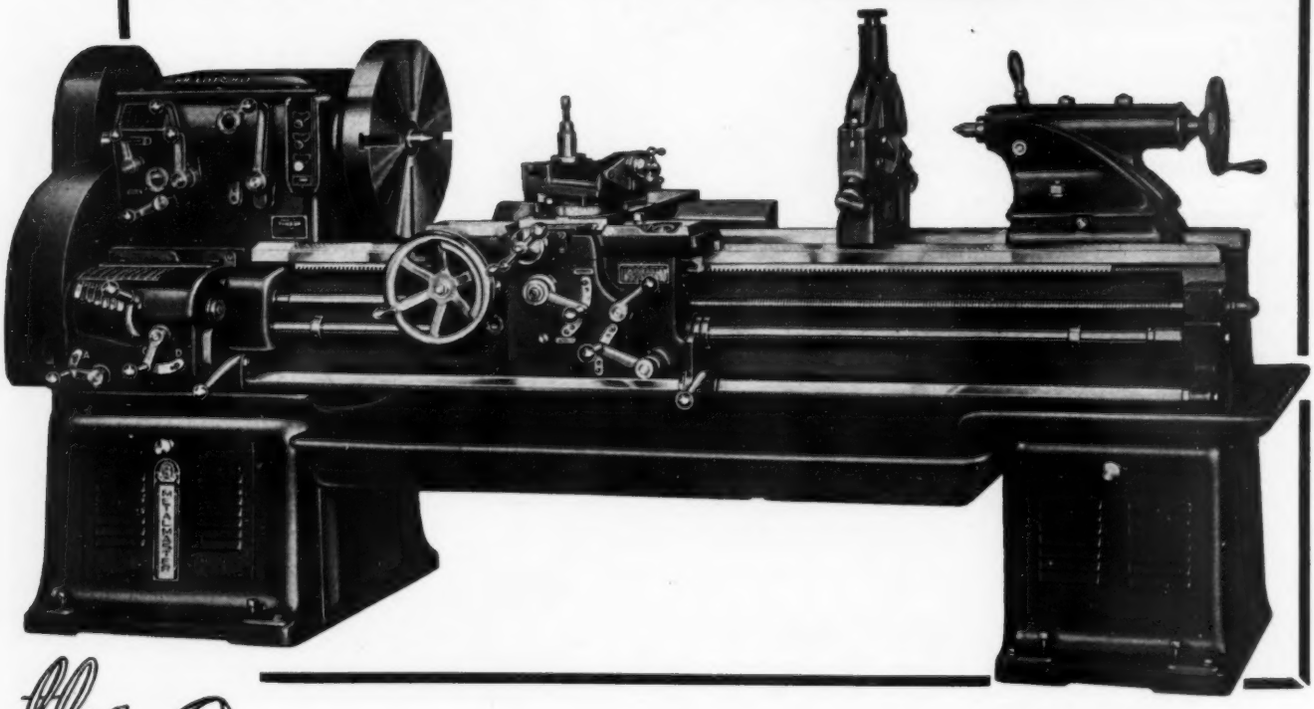
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

5600 ST. JEAN · DETROIT, MICH.

STURDY—TO HANDLE MANY JOBS . . .
VERSATILE—TO HANDLE A VARIETY OF JOBS



the Metalmaster

FROM HEADSTOCK TO TAILSTOCK, THE *METALMASTER* IS A PRODUCT OF HIGHLY SKILLED ENGINEERING DESIGN AND MODERN MANUFACTURING METHODS . . . THE *ULTIMATE* IN A SPEEDY METAL TURNING UNIT.

THE METALMASTER TAILSTOCK is a most important lathe item, and is treated as such by Bradford. Great care has gone into the design and construction of this element. Of the off-set pattern, the tailstock is long and heavy, and can be depended upon to retain alignment. The compound rest can be set at right angles with the bed ways when turning between short centers . . . also, it can be set over for tapers. The spindle is of forged steel, carefully ground and locked by split bushings which greatly prevents misalignment with the headstock spindle. This tailstock is strong and sturdy . . . well able to serve under today's expanded conditions.

THE METALMASTER'S ATTACHMENTS are designed and bulit with the same care as the lathe itself. The FOLLOW REST is simple and rigid . . . easily attached to the carriage when needed to support long or light work. DRAW-IN COLLET attachment allows a speed-up on bar stock work—can be quickly attached. MICROMETER POSITIONING STOP provides a positive stop for turning numerous pieces to uniform length. THREAD CHASING STOP can save time on production work. TAPER TURNING ATTACHMENT has large range, is rigid and accurate. LEAD SCREW REVERSE makes it possible to reverse direction of the carriage under power without changing the direction of rotation of headstock spindle. All these attachments add VARIETY to the METALMASTER'S operation . . . important for today's speeded delivery requirements.

This advertisement is one of a series describing in detail the principal elements of the Bradford Machine Tool Co.'s new METALMASTER Geared Head Lathes. Write for complete story in one convenient folder.

METALMASTER SIZES:—12", 14" and 16" swing,—6' to 16' bed.

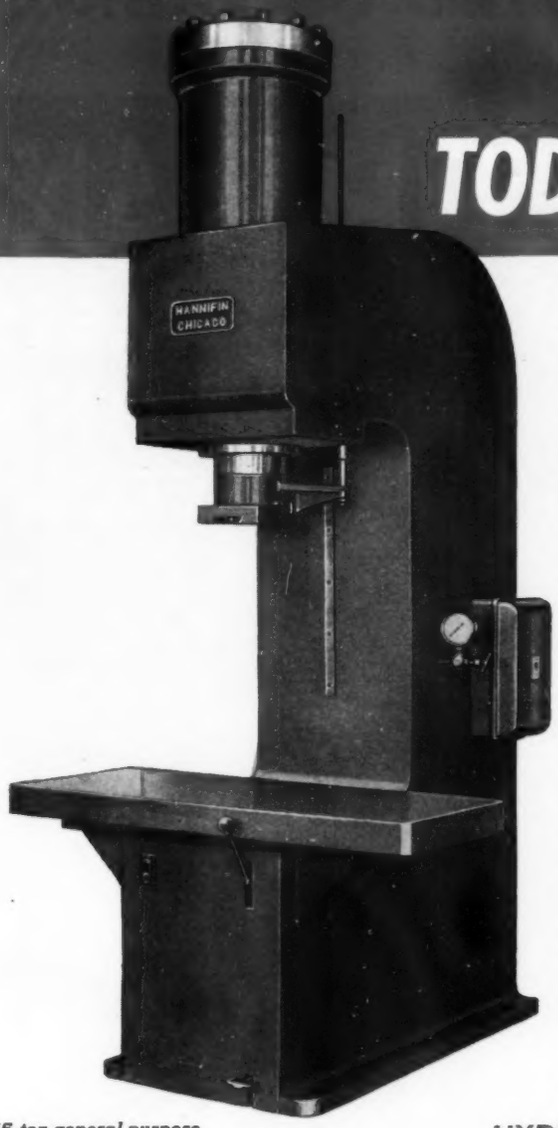
THE BRADFORD MACHINE TOOL CO.

CINCINNATI, OHIO

MAKERS ALSO OF UNIT TYPE DRILLING & TAPPING EQUIPMENT

PRECISION TOOLS SINCE 1840

Adaptable to TODAY'S PRODUCTION



75-ton general purpose assembly press

HANNIFIN pneumatic and hydraulic equipment is contributing to fast production in hundreds of plants building machine tools, aircraft, armament, trucks, and other essential equipment. The same Hannifin features of fast, accurate, easy handling of production operations are proving their value over again on today's jobs.

HANNIFIN HYDRAULIC PRESSES

Hannifin press design utilizes every advantage of standardization, yet permits ready modification to meet individual needs. Welded steel frame construction, built-in hydraulic power units, standard cylinder construction, and simple controls are proved Hannifin features of construction. Press performance can be adapted to specific needs by modifications in table construction, gap, reach, and ram stroke. Ready adaptability avoids delays due to special design. Ram stroke is adjustable, to avoid unnecessary up-travel of ram in production operations. The exclusive Hannifin sensitive pressure control provides finger-tip control of *ram pressures*, with simple, natural handling that means consistently faster, more accurate work.

For production straightening, press-fit assembly, forming, or similar work involving the application of pressure, find out what Hannifin hydraulic press performance can accomplish for you. Consult Hannifin engineers for specific recommendations.

"HY-POWER" HYDRAULIC RIVETERS

The "Hy-Power" hydraulic operation, originated and perfected by Hannifin, combines a high speed automatic cycle, easy operation and control, and simple handling of work, to deliver sustained high production. The push button controlled "Hy-Power" riveting cycle includes: 1. Rapid advance stroke; 2. Automatic high pressure working stroke; 3. Automatic reversal at maximum pressure; 4. Rapid return stroke. The automatic reversal at maximum pressure, governed by work resistance, contributes to better and more uniform riveting, and provides automatic compensation for variations in rivet length within the capacity of the unit.

Write for bulletins giving complete data on "Hy-Power" equipment for riveting, punching, press-fit assembly, forming, and similar work.

HYDRAULIC CYLINDERS

Precision construction with mirror-finish honed cylinder bores and high efficiency piston seal means maximum utilization of hydraulic power. Hannifin no-tie-rod construction gives a stronger cylinder assembly, with simple application and easy adaptability to many different types of use. Available in a full range of sizes. Write for Bulletin 35.

PNEUMATIC CYLINDERS

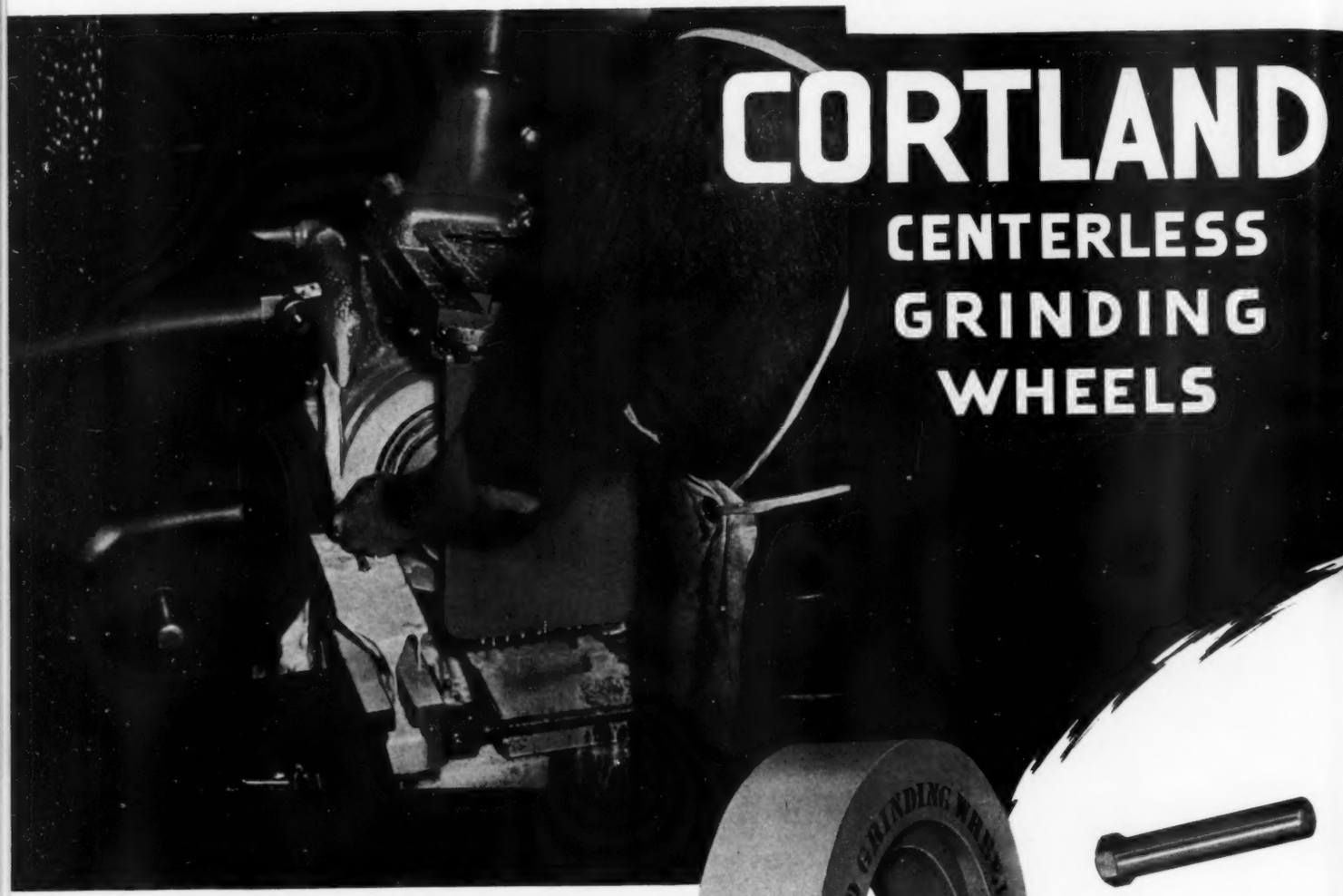
Bored and honed cylinder bodies, and simple outside adjustment of piston packing provide for maximum use of air power, minimum friction loss, and long, trouble-free service. Many standard mounting types, sizes 1 to 16 inches bore, for any length stroke. Write for Bulletin 57.

HANNIFIN MANUFACTURING COMPANY

621-631 South Kolmar Avenue • Chicago, Illinois

HANNIFIN PNEUMATIC-HYDRAULIC PRODUCTION TOOL EQUIPMENT

INDIAN MOTOCYCLE CO.
to approve two outstanding



20% INCREASE IN THEIR PRODUCTION DUE TO THESE WHEELS

As a result of changing to CORTLAND wheels, Indian effected a 20% increase in their centerless grinding production! They report that the degree of finish produced is "Excellent", and further state that Cortland Centerless Grinding Wheels have proven adaptable for all around work.

The motorcycle part shown is typical of the various pieces of carbon steels and chrome-nickel alloys being ground at this plant with Cortland Centerless Grinding Wheels.

Indian Motocycle Co. is just one of many prominent grinding wheel users who are swinging to CORTLAND products. More and more users are finding that, under the pressure of war requirements, CORTLAND wheels are helping them attain ever higher production goals.

Write for further information about
CORTLAND CENTERLESS GRINDING WHEELS

CORTLAND GRINDING

IS ANOTHER LARGE USER
Cortland-improved products

CORTLAND
CHUCK AND SEGMENTS

"GAVE GOOD FINISH TO WORK, CUT FREE, DID NOT HEAT"

That's what Indian Motocycle Co. says of the new improved CORTLAND chuck and segments, which they now specify for grinding clutch plates and carbonized steel rings.

Not only is the grinding action superior to that of solid ring wheels formerly used, but the work is speeded up—a vital factor in Today's call to action! The Indian Motocycle Co., to quote again from their report, "likes the idea of the quick change of segments."

You, too, will like the speed and accuracy of the New CORTLAND chuck and segment assembly. Its up-to-the-minute improvements make it DIFFERENT from any other chuck and segments on the market!

Write for descriptive literature on the NEW CORTLAND SEGMENTAL CHUCK

WHEELS CORP. CHESTER MASS.

Since 1875 • SPECIAL INDUSTRIAL MACHINERY • Since 1875

This Broom-Stitcher Was Once a Prime Tool!

Yes, over 50 years ago, low-cost brooms were one of the crying needs of civilization and progress. Lipe helped to make them possible by this automatic broomstitcher. For 67 years, Lipe inventors and skilled mechanics have designed and built machines to supply many of industry's special needs.

TODAY, the

LIPE

CARBO-MATIC LATHE

turns tough armament steels to rough-grinding contours with only one pass

TURNING to rough-grinding tolerances with only one pass, the LIPE CARBO-MATIC LATHE gives cutting speeds, rates of feed and depths of cut that were undreamed of five, or even three, years ago.

That's because the LIPE CARBO-MATIC was designed especially for carbide tools. Designed for tough armor plate alloys and armor-piercing projectiles . . . for the multiple-part production of mechanized warfare . . . and for the unimagined productions of a more-thoroughly mechanized peace.

LIPE CARBO-MATICS are Massive and Rigid. Result . . . *Out-of-round, out-of-true, chatter, tool breakage and scrap are held to a minimum. Tools give more cuts between grindings. The finish of the work mirrors the story of the smooth-flowing power.*

This lathe is fully automatic. Hydraulic control governs the holding equipment, longitudinal and cross feeds and tailstock quill.

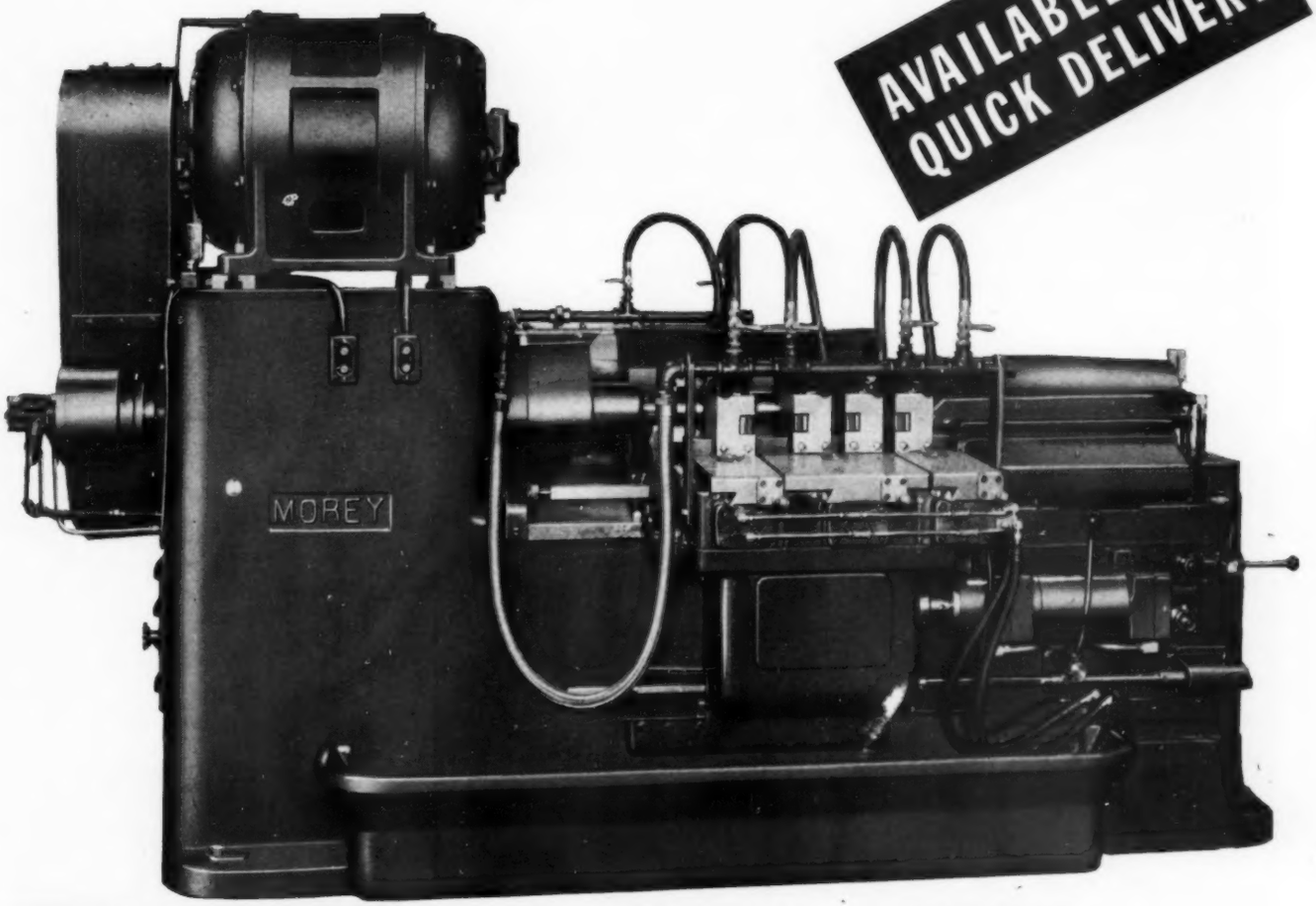
Swing over carriage 8″, between centers 30″. Write for delivery dates.

LIPE-ROLLWAY CORPORATION

Syracuse, N. Y.

for ROUGH and FINISH TURNING SHELLS 105 M.M. to 155 M.M.

AVAILABLE FOR QUICK DELIVERY



THE MOREY "27" SHELL LATHE . . . .

- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

This Morey Lathe is equipped with Timken Tapered Roller Bearings for main spindle—all others anti-friction.

Hydraulic Feed: insures almost effortless operation.

Heavy Duty: rigid enough to use carbide tools to their full capacity.

Semi-Automatic: a complete feed and return cycle; a single movement of the starting lever starts the spindle revolving and the tools feeding. When work is completed, tool is returned to loading position, spindle is stopped and the work unclamped ready for removal.

The Morey "27" is entirely self-contained—no outside or auxiliary equipment is required.

SEND FOR CIRCULAR NO. 715-A

MOREY MACHINERY CO., Inc.

410 BROOME ST. . . . . NEW YORK, N.Y.

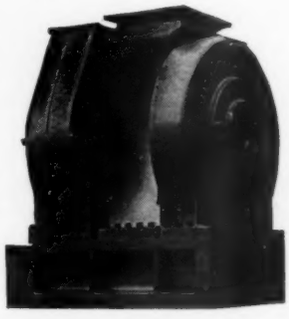
LARGE JOBS
SMALL JOBS
SPECIAL JOBS

Swaging

HANDLES THEM ALL SATISFACTORILY!

Here are three of the jobs upon which ETNA SWAGING MACHINES are being actively employed today. These three examples represent only a small percentage of the varied work that ETNAS are doing. But they serve to demonstrate how and where you can save by Swaging. Particularly today, when all-out speed is needed to meet urgent war needs, Swaging is important. You can often eliminate machining operations . . . improve quality . . . increase output by Swaging with ETNAS.

Therefore, it's well to remember—if you taper, size or reduce round solids or tubing . . . if you fabricate small tubular assemblies . . . investigate Swaging . . . ask ETNA. Swaging Machines by ETNA are built in standard sizes with die lengths up to 18", and diameters up to 8". Larger units are built to order. Write, wire or phone today!



Here's a large job . . . this ETNA Swaging Machine is turning out large axle housings at a rapid rate . . . reducing one section from 4½" O.D. to 3" O.D., while increasing wall thickness from ¼" to .360". Tubes are automatically fed.

Here's a small job . . . the swaging of a narrow copper band around a 20 m.m. shell. Production rate is surprisingly high.

Here's a special job . . . a single ETNA doing three operations on an army cot leg. First, the design is knurled on. Second and third operations consist of tapering and sizing the ends of the leg. Production rate —50 legs per hour.

IF IT'S A QUESTION OF TAPERING, SIZING OR REDUCING OF ROUND SOLIDS OR TUBING

"Ask ETNA about Swaging"

THE ETNA MACHINE COMPANY

TOLEDO . . . OHIO

PITTSBURGH

FIFTY-INCH BORING AND TURNING LATHE

● Heavy Duty Face Plate Drive Lathe, sixteen speed head—eight through spindle and eight through face plate pinion—equipped with quick change gear box for thread cutting and regular turning, through extra heavy lead screw, with standard carriages and compound rests.

● Lathe arranged for boring with boring screw mounted in center of bed operating boring bar carriage and bar support. Can be used for boring and turning at same time, thereby increasing production.

• *Write for Complete Details* •

SOMMERFELD MACHINE COMPANY

BRADDOCK • PENNSYLVANIA

REID • SMALLPEICE

MULTI-TOOL PRODUCTION • LATHE •

FOR WORK UP TO 58" BETWEEN CENTERS AND 18" SWING

• • • providing all operations for single purpose work with facilities of all-purpose machine

• • IDEAL FOR ARMAMENT PARTS PRODUCTION

Designed and constructed to keep pace with fast production, the REID SMALLPEICE Production Lathe combines the strength for heavy cuts at fast speed with versatility for handling a wide variety of jobs. This combination makes it a valuable machine for armament work.

Unit design, with provision for a wide range of slides, overarms and similar attachments which are available for easy mounting, make it possible to convert this lathe into a special purpose automatic. Jobs ordinarily requiring many machines can be handled in a fraction of the floor space on this machine.

DESCRIPTIVE BULLETIN AVAILABLE

. . . *Promptly on request*

TYPICAL EXAMPLES OF WORK PRODUCED ON REID SMALLPEICE MULTI-TOOL LATHES

The extreme versatility of this lathe is evident from the class of work it will handle. It may be adapted easily to special jobs and yet remain an all-purpose machine for regular turning, boring, facing and profiling. Stripped of attachments it is a sturdy center lathe for single operation in tool room or shop. Work for which special equipment is available includes:

- Shafts
- Drill Reamer Blanks
- Gears and Bevel Gears
- Ring Type Gears
- Commutators
- Rotors
- Water Fittings
- Bearings
- Aeroplane Valves
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- Test Pieces
- Pistons
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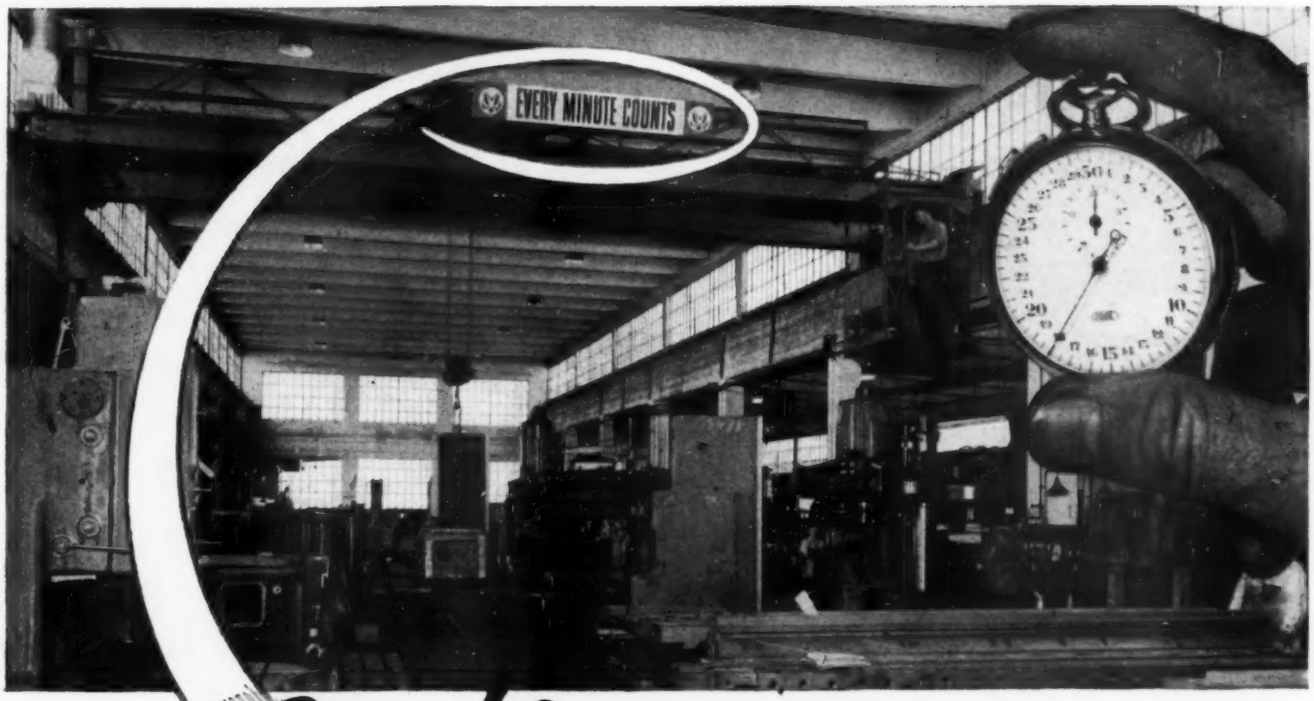
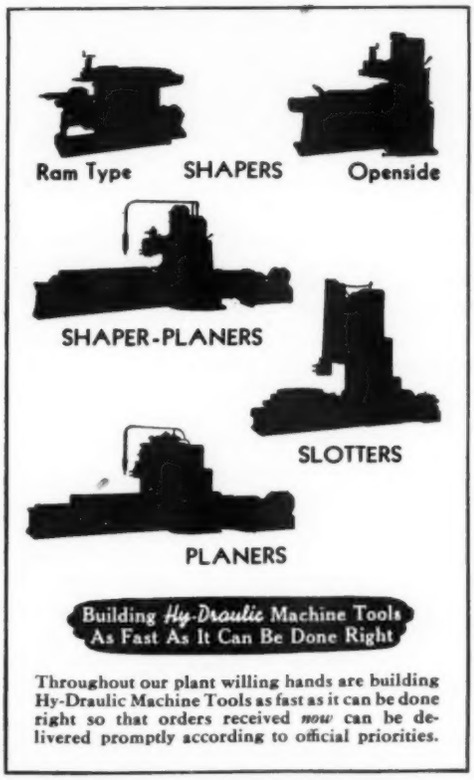
- Cylinders Liners
- Crankshafts
- Bushes

SMALLPEICE, LTD. 160 Elliott St., Beverly, Mass.
Manufactured in U. S. by REID BROS., INC., Beverly, Mass.



Making EVERY MINUTE COUNT

AND- Building *Hy-Draulic* Machine Tools As Fast As It Can Be Done Right



Throughout our plant willing hands are building Hy-Draulic Machine Tools as fast as it can be done right so that orders received *now* can be delivered promptly according to official priorities.

☆Walk through the shop any day or night — after establishing identity right down to your birth-mark, if any. But keep moving, and don't bother anybody. The place is full of earnest workers, grimly intent on making every minute count in building Hy-Draulic Machine Tools as fast as it can be done right. ☆All on high-urgency orders, Hy-Draulic Machine Tools are required for vital war work because they can make every second of every minute count. Their hydraulic drives and feeds get the last ounce out of cutting tools, make it easy for operators to produce maximum quantities of highly accurate, finely finished work every shift. ☆The 36″ Openside Hy-Draulic Shaper and the Hy-Draulic Shaper-Planer are especially useful in handling a raft of work that makes the biggest ram-type shapers say "Uncle", yet can't be done as economically on other machines. ☆Note: Peace-time features and advantages, that create increased demand for Hy-Draulic Machine Tools on war work, will be even more valuable in the peace that follows Victory.

Hy-Draulic
Reg. U. S. Pat. Off.

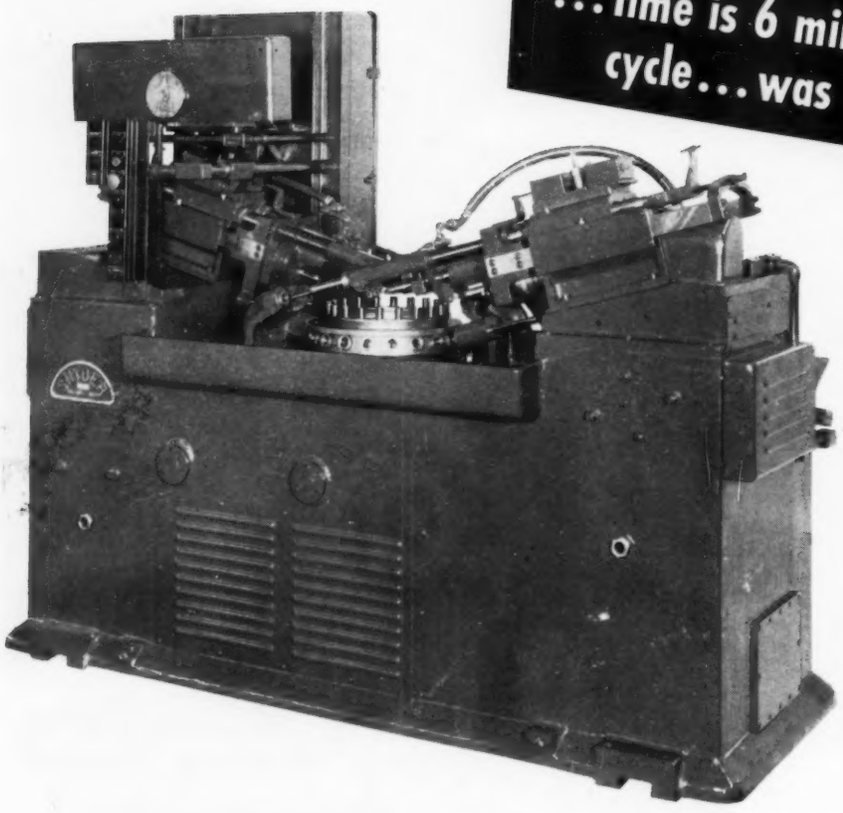
Shapers..Planers..Slotters..Shaper-Planers

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U.S.A.

WRIGHT AERONAUTICAL

"... time is 6 minutes for the complete cycle... was 44.5 minutes..."



Drilling 40 holes in 20 passes

•

Automatic Indexing

•

Smooth drill finish

•

1600 holes per drill per grind

A SNYDER Hydraulic Drilling Machine

THIS Snyder special machine is used to increase production in drilling oil holes diagonally through the trunnions of a reduction gear carrier ring.

The time required for this operation on previous equipment was 44.5 minutes.

On the Snyder machine, the operation consists of drilling 40 holes, .078 in diameter, 2 holes in each pass in an automatic indexing fixture, indexing 20 times.

The holes are drilled to a certain depth and then redrilled to a greater depth. The drill finish is satisfactorily smooth.

The time cycle for the entire operation is 6 minutes.

In addition to a production increase of 700% accomplished by reducing the time cycle of the operation from 44.5 minutes to 6 minutes, two major economies are achieved—

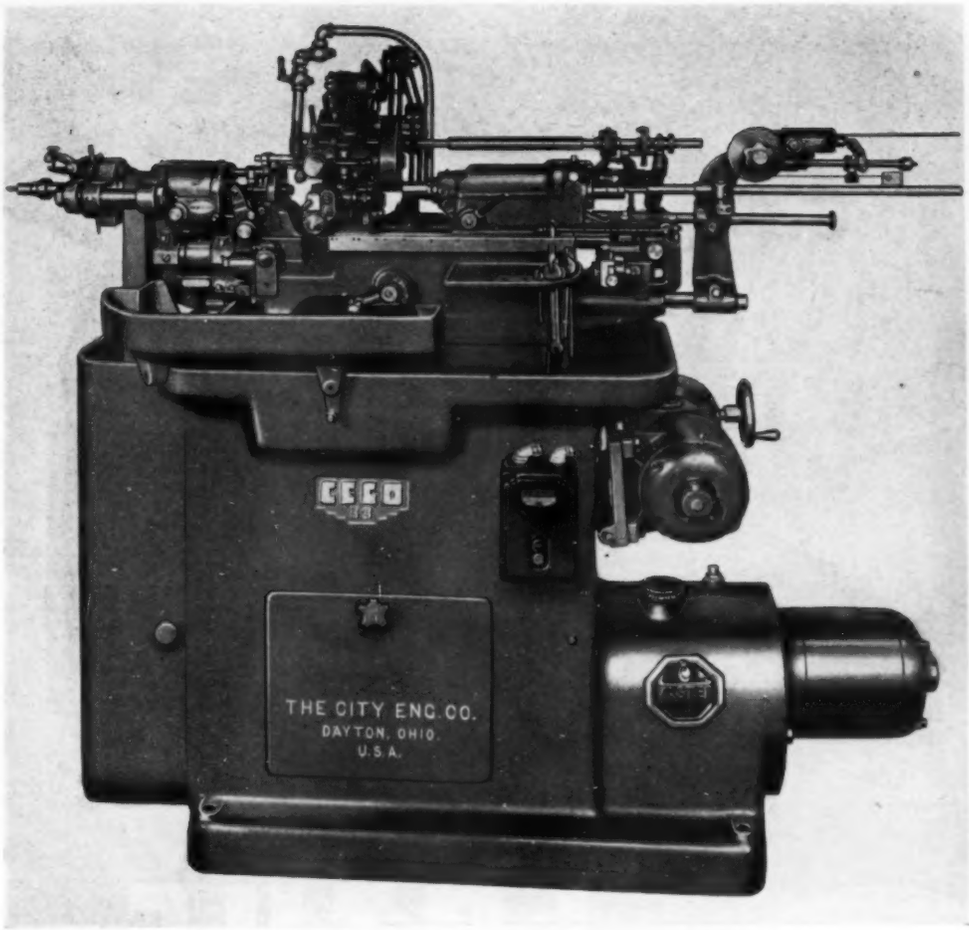
the automatic indexing feature greatly reduces handling

hydraulic tool feed gives uniform rate of feed and longer tool life, Wright Aeronautical reporting 1600 holes per drill per grind

Perhaps we can help you to accomplish comparable economies in your production.

SNYDER
TOOL & ENGINEERING CO.
3400 E. Lafayette Ave. • Detroit

designers and builders of machinery for **HIGH** *production at* **LOW** *unit cost*



FOR EXTREME ACCURACY OF SMALL PARTS

CECO Automatic SCREW MACHINE

THE CECO Swiss Type screw machine differs from the conventional automatic screw machine in that no indexing turrets—box tools—nor form tools are used. Instead four simple, inexpensive standard tool bits, which are easily ground on ordinary tool grinder, perform all the operations usually done with more complicated box and form tools. There's a big saving in tool costs.

Accuracy of diameters and lengths of shoulders are maintained with double micrometer adjustments. Odd shapes — complicated forms and tapers are produced without forming tools by generating flat cams mounted on the cam shaft.

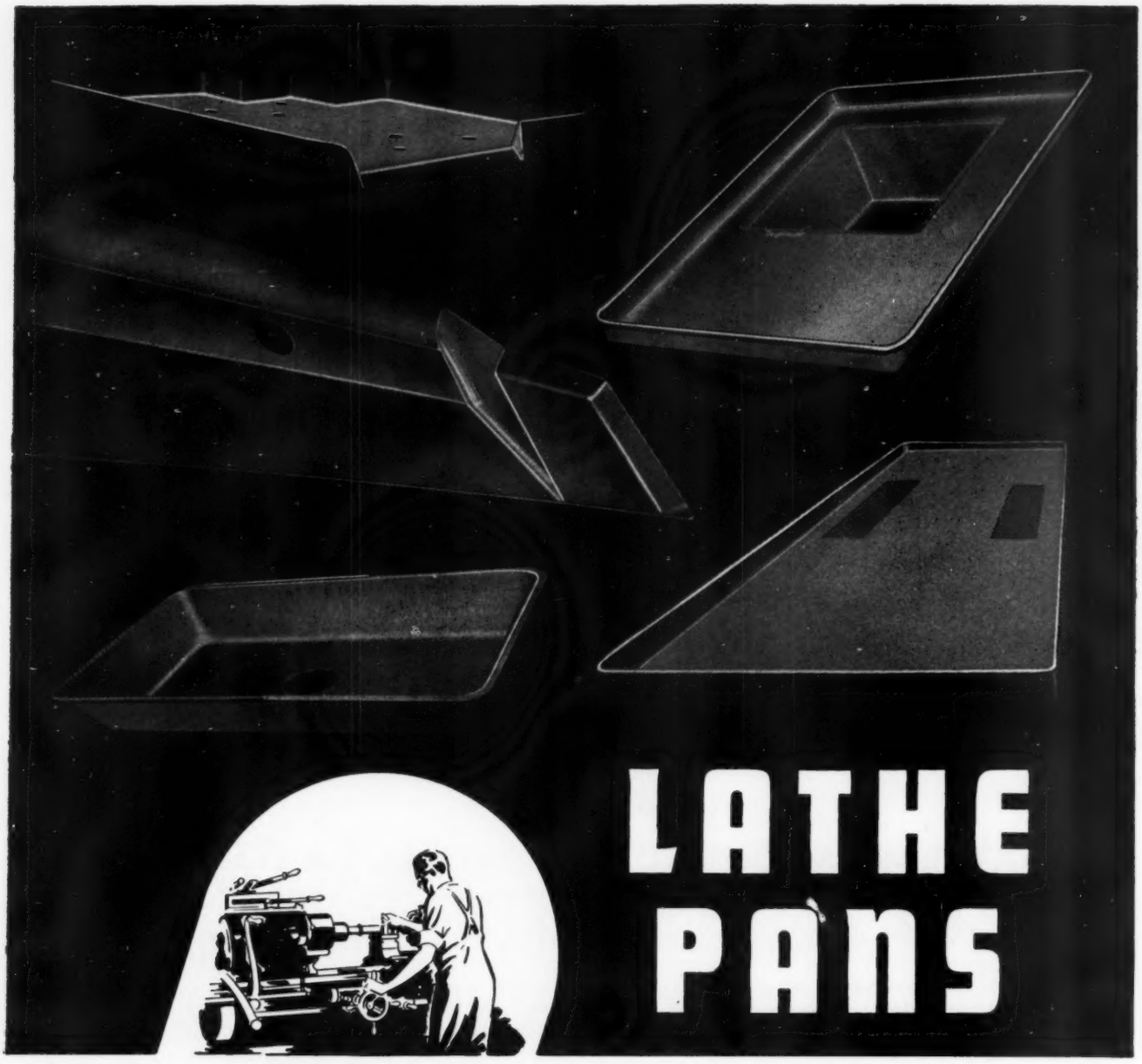
Drilling, reaming, counterboring, tapping, threading and similar operations are accomplished by attachments mounted at end of machine. Auxiliary operations such as slotting screw heads may be accomplished while other operations continue by means of pick up arm carrying work to attachment and cutter mounted at front of machine.

The CECO is made in three models, the Model 4-3-8 having four tool slides, with 2¾ max. turning length and ⅜ bar capacity; the Model 5-3-8 having five tool slides, with 4" maximum turning length and ⅜ bar capacity and the Model 5-4-8 having 5 tool slides with 4" maximum turning length and ½ bar capacity. Individual variable speed units power camshaft and work spindle adding flexibility and ease of operation—eliminating change gears and pulleys—providing vibrationless, noiseless operation and exceptionally close tolerances on fine work.

Many plants with contracts for accurate parts for intricate machanisms of some of our important War units find Ceco Automatics do the work better—faster.

For further details, write.

THE CITY ENGINEERING CO.
DAYTON . . . OHIO



SPECIAL METAL PARTS
LOUVRE COVERS
MACHINE BASES
SPLASH GUARDS
GEAR GUARDS

Why slow up "Victory Production" due to lack of supplies. Our large and modern special fabricating department can turn out Lathe Pans, Gear Guards, etc., any size and shape with speed and accuracy. Let us make one unit and you be the judge. We are equipped to give prompt delivery—Send in blueprints for prices today.

LITTLEFORD

Fabricators of Plate and Sheet Metals

LITTLEFORD BROS., INC. 434 E. PEARL ST., CINCINNATI, OHIO

MUNITIONS MANUFACTURERS

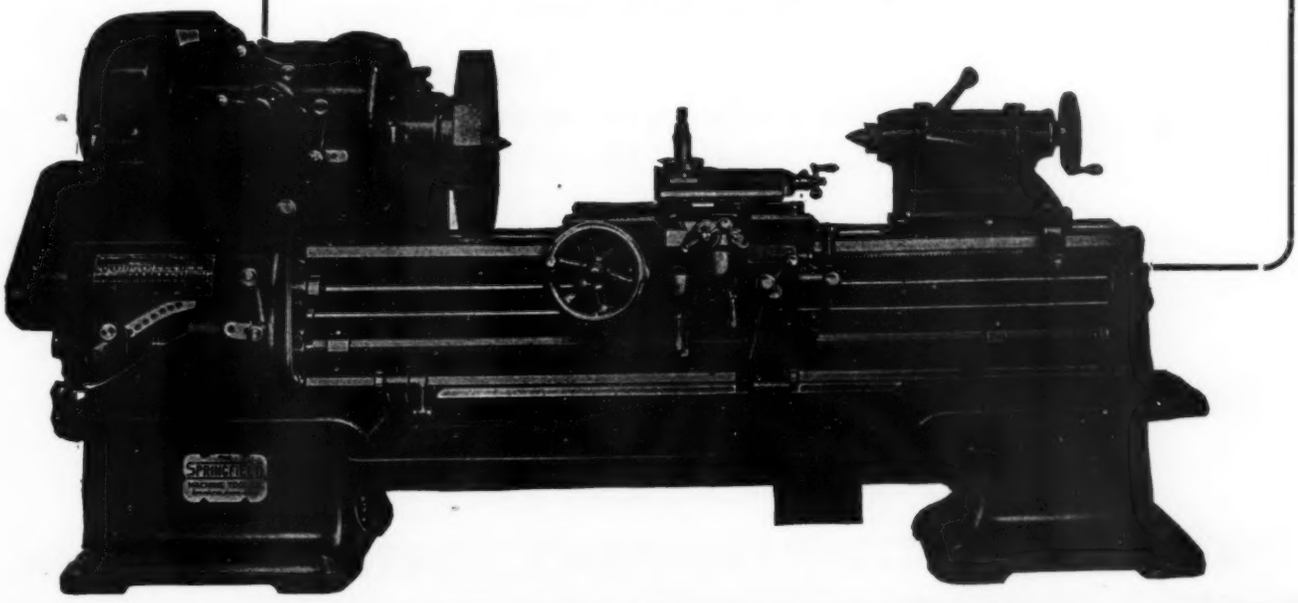
...LOOK TO SPRINGFIELD PRECISION LATHES!

. . . here is a lathe which is truly modern from headstock to tailstock. Features which are especially timely, mark it as an outstanding value for both tool room and quantity production use. Primary among these features—one that assures accuracy, and therefore is of great importance to munitions manufacturers—is MATERIALS.

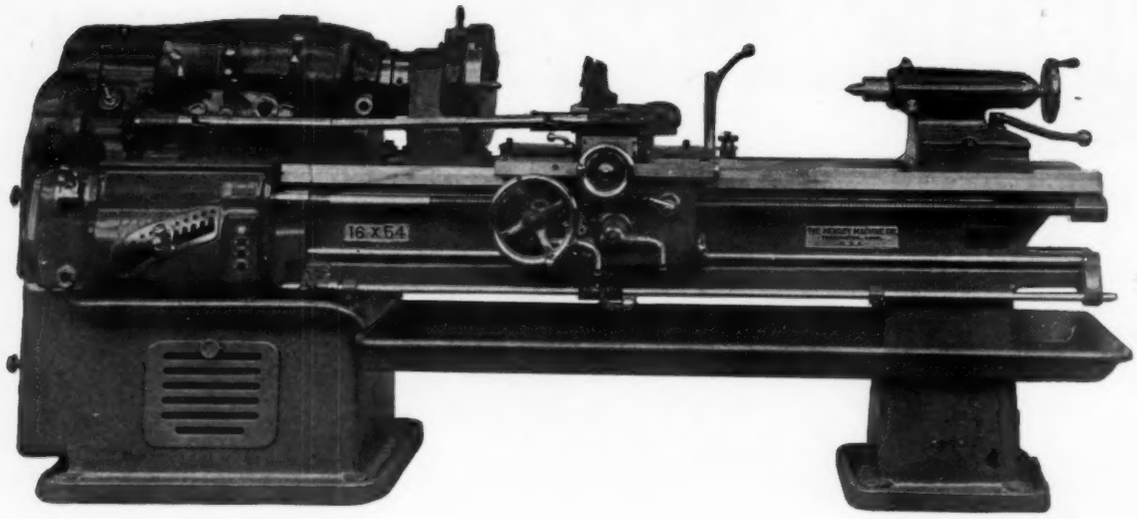
Springfield Lathe beds are made in our own foundry—of highest nickel-chrome gray iron—an operation that enables us to *guarantee* strength and wear-resisting qualities . . . allows us to follow through on each casting operation . . . makes *certain* every rigid standard we specify. Springfield iron itself, too, is especially resistant to warping and marring, even under severest service. Here, then, are factors that account for the sustaining, over long periods of use, of the original accuracies built into every Springfield Lathe.

The SPRINGFIELD **MACHINE TOOL** *Co.*

SPRINGFIELD, OHIO



Retooling, especially for munitions manufacturers, should take into consideration (1) extreme **ACCURACY** and (2) maintenance of such accuracy. In other words, **LONG LIFE**. And the Springfield Lathe delivers both!



HENDEY

The Hendey lathe as illustrated is equipped with sub headstock and relieving attachment. With this equipment it is capable of

Chasing screw threads having very long leads;
Turning and relieving wide forming cutters;
Turning and relieving hobs with long leads;
Relieving milling cutters with large numbers of teeth;
Turning work on dead centers.

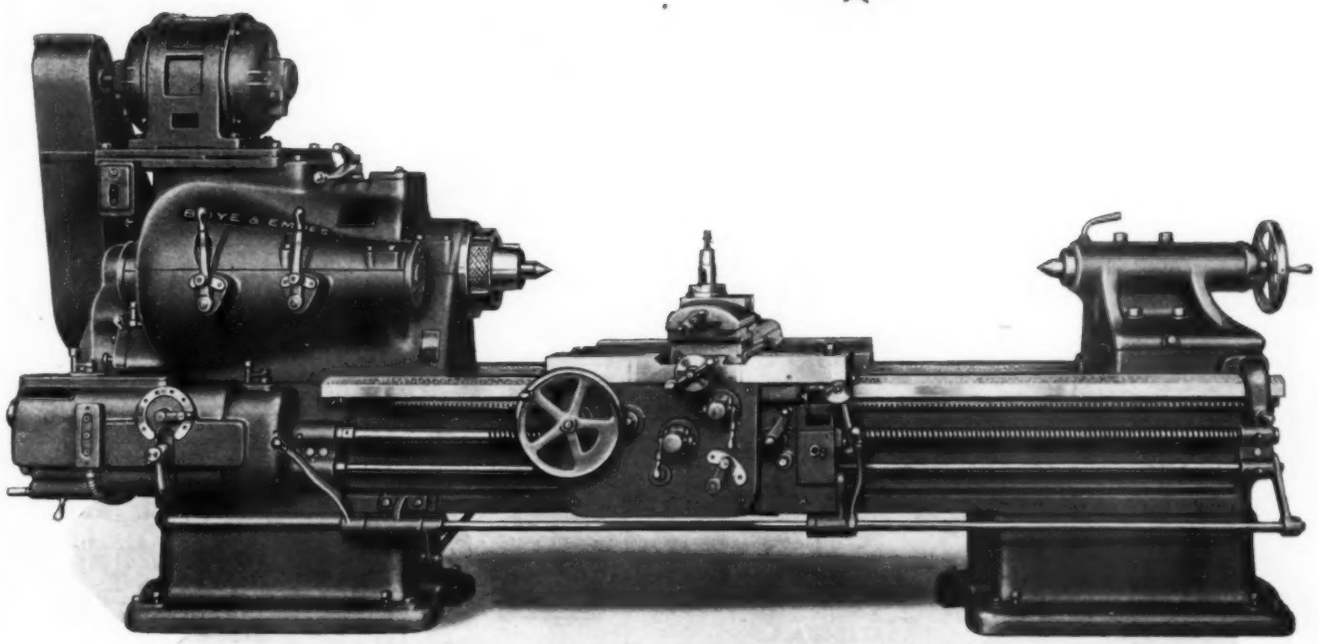
And it is still a 100 percent Precision-Production lathe capable of taking care of every variety of work which may be done in an engine lathe.

THE HENDEY MACHINE COMPANY, TORRINGTON, CONN.

BOSTON NEW YORK ROCHESTER DETROIT CHICAGO

BOYÉ & EMMES LATHES

★



★

THE BOYÉ & EMMES MACHINE TOOL CO.

CINCINNATI, OHIO

★

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QUEEN CITY

BALL BEARING

BENCH, PEDESTAL and DISC

GRINDERS

Built in a complete range of sizes in bench, pedestal, and heavy duty box type bases from ½ H.P. to 10 H.P. units.

This grinder is a powerful—sturdy unit equipped with two Carborundum wheels, one course, one fine—safe enclosed guards with built-in exhaust—Allen Bradley push button switch with overload protection—adjustable and safe work rests—tool tray—water pot—adjustable, shatter proof, clear glass eyeshields.

You can also save on initial cost with Queen City Grinders.

QUEEN CITY DEALERS ARE STRATEGICALLY LOCATED FOR YOUR CONVENIENCE.

Smith-Booth-Usher Co.	Los Angeles, California
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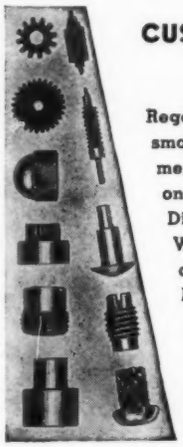
West Coast Machinery Co.	Seattle, Washington
State Machine Tool Co.	Milwaukee, Wisconsin
M. J. Byrns	Washington, D. C.

QUEEN CITY MACHINE TOOL CO.

218 EAST SECOND ST. CINCINNATI, OHIO

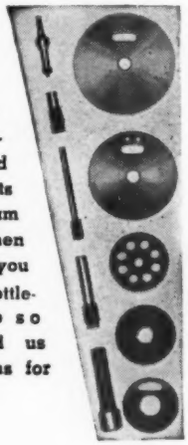
NATIONAL DEFENSE

demands complete cooperation of every industry, every manufacturer, every single person . . . The Waltham Watch Company is ready to serve you with custom-made parts to closest tolerances.



CUSTOM-MADE PARTS

Regardless of your small parts requirements, you can depend on the Custom Parts Division of Waltham Watch Co. . . . Our men are ready to help you break those "bottlenecks" that are so bothersome. Send us your specifications for small parts.



WALTHAM WATCH CO.

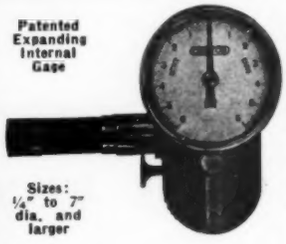
CUSTOM PARTS DIV.

Waltham, Mass.

COMTORPLUG equalizes their gaging ability!

Untrained users gage accurately to fractions of .0001" COMTORPLUG

Patented Expanding Internal Gage



Sizes: ¼" to 7" dia. and larger

Because of automatic 2-point gaging features, Comtorplug gives ordinary operators "inspector-accuracy" in gaging bores to fractions of a ten-thousandth. This unique gage shows ACTUAL SIZE, not merely a "go and not-go" range, and also detects such inaccuracies as out-of-round, front or back taper, bell mouth, barrel shape, etc. For airplane, ordnance, automotive, electrical and all shops working to close tolerances.

Request Bulletin 27

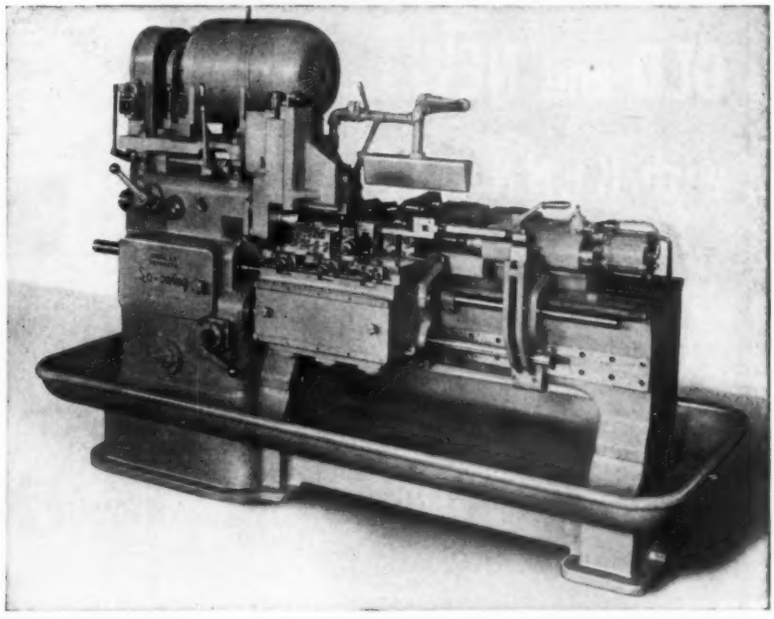
THE COMTOR CO.

68 Rumford Ave.
Waltham, Mass.

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

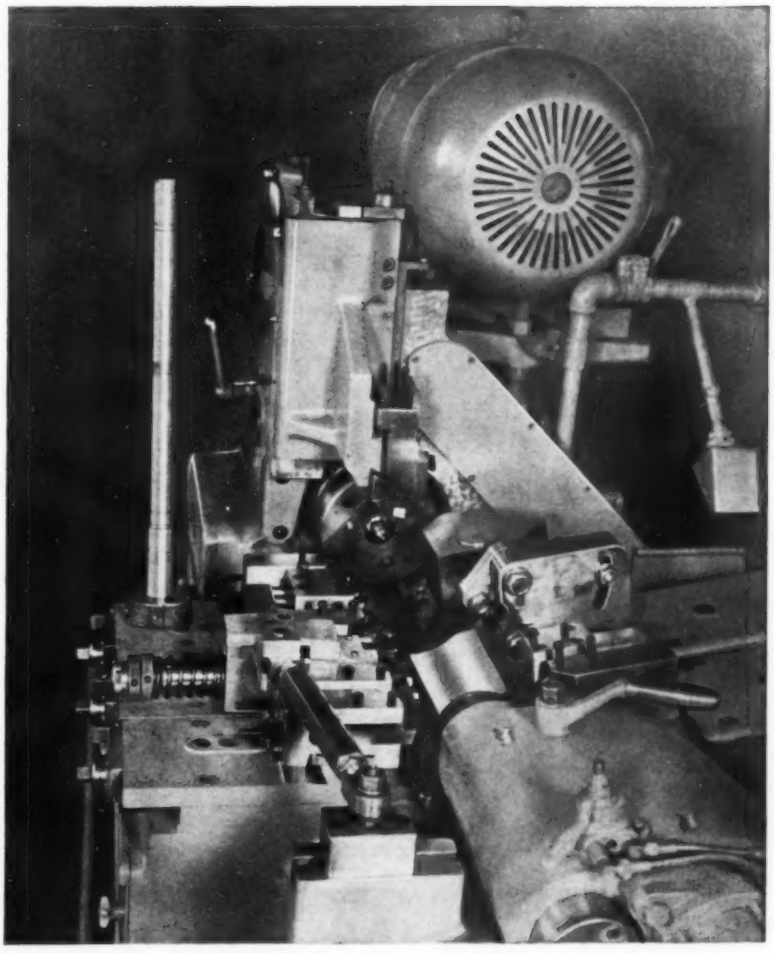
STANDARD ATTACHMENTS EQUIP MODEL LR *Lo-swing* LATHE FOR MULTI-OPERATION SHAFT JOB



Problem: **To provide a single, automatic machine capable of performing the following operations on transmission shafts on a production basis: Completely turning OD; facing, grooving and 45° undercutting the head end; grooving and chamfering the small end.**

Solution: **A Model LR Lo-swing Lathe was selected for this job primarily because it provided the required capacity. It was equipped with the following standard Lo-swing Attachment: One 3-slide Front Carriage; two Back Attachments—one carrying tools and the other a 2-roll Steady Rest; one Third Slide or Overarm, and one 45° Undercutting Attachment, operated by the Front Carriage.**

The lathe is completely automatic and performs its operations in the following sequence: Operator loads the work and starts the machine; one of the tools on the Center Slide of the Front Carriage spots the Shaft for a Steady Rest bearing; Steady Rest on the Back Squaring Attachment moves in to support the work. Then simultaneously the other tools on the Front Carriage turn the OD of the Shaft—tools on the Overarm face and groove—tools on the second Back Attachment chamfer and groove, while the Undercutting Attachment tool undercuts the head end at a 45° angle.



Close-up of tooling. Finished Shaft may be seen standing on lathe carriage.

Get More Work from OLD and NEW machines with KENNAMETAL Tools

KENNAMETAL THE All American CARBIDE

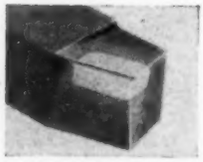
Regardless of whether your machines are old or new, KENNAMETAL can turn out more work for you. If sufficient power is available to obtain the higher speeds possible with KENNAMETAL, even the oldest machine can use KENNAMETAL effectively.

KENNAMETAL turns, bores and faces steels of hardnesses up to 550 Brinell at speeds 2 to 6 times faster than are possible with high speed steel tools. In addition, it removes 3 to 10 times as much metal between regrinds . . . and often combines roughing and finishing cuts in one operation.

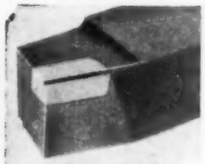
All these advantages add up to one thing — more work per hour per machine — whether the machine is old or new. Write today for the new KENNAMETAL Vest Pocket Manual, showing just how to apply KENNAMETAL for the utmost in production.

STYLE 6 TOOL

STYLE 3 TOOL



STYLE 12 TOOL



STYLE 11 TOOL

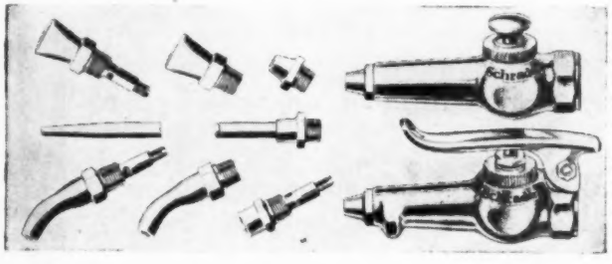
INVENTED AND MANUFACTURED IN U. S. A.

McKENNA METALS Co.
103 LLOYD AVE., LATROBE, PA.
Foreign Sales, U. S. STEEL EXPORT CO. 30 Church St. New York
Exclusive of Canada and Great Britain

THIS BLOW GUN

IS PRACTICALLY INDESTRUCTIBLE

You can give the Schrader Stainless Steel Drop Forged Blow Gun the roughest kind of handling and rarely find need to replace it. We dropped one eleven stories onto concrete pavement. We ran over it with a heavy electric truck, without doing a bit of damage. Mechanics like it because it fits the hand naturally, and the hang-up hook acts as a finger guard. Working parts are easily accessible. Because this Schrader Gun has extra long life, it is the most practical gun for you in times like these.



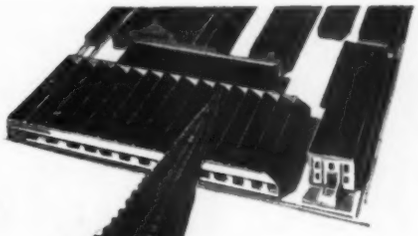
Send for Catalog #10. It not only shows the various types of Schrader Blow Guns and interchangeable noses but Pneumatic Safety Machine Controls, Ejection Sets and Air Line Fittings that conserve compressed air. Write today.

Schrader
REG. U.S. PAT. OFF.

AIR VALVES, GUNS, FITTINGS AND MACHINE CONTROLS

A. SCHRADER'S SON BROOKLYN, N. Y.
Division of Scovill Manufacturing Company, Incorporated

EVERY DAY *more* AXELSON LATHES...



Every day from the Axelson plant flows a steady stream of Axelson Heavy Duty Lathes. They are destined for war production plants all over the country whose job it is to build *more and more* materials that are vital to our country's victory program.

Since before World War I Axelson has been building lathes of unexcelled performance. During this time Axelson *has never* rationed the quality of materials and workmanship that are combined in producing a lathe recognized for precision, speed and economy. From guns to caissons, airplanes to motors, let an Axelson Lathe help you "keep step" with today's production demands.

It will pay you to investigate Axelson Lathes. They are performing multiple duties in war production plants throughout the vital metal working areas of the nation. Send NOW for illustrated literature. No obligation!

BEFORE YOU BUY ANY LATHE INVESTIGATE

AXELSON!

AXELSON 50th YEAR 1892 1942

AXELSON BUILDS LATHES IN 14", 16", 18", 20", 25" AND 32" SIZES

AXELSON MANUFACTURING COMPANY
6160 Boyle Ave. (P.O. Box 98, Vernon Station), Los Angeles, Calif.
50 Church Street, New York — 3844 Walsh Street, St. Louis

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WASHINGTON . . . G. H. Lynn, *Direct Factory Representative*
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WILLARD Spring TOOL HOLDERS

FINER QUALITY WORK AND FASTER CUTS—ASSURED WITHOUT CHATTER OR DANGER OF TOOL BREAKAGE . . . . . .

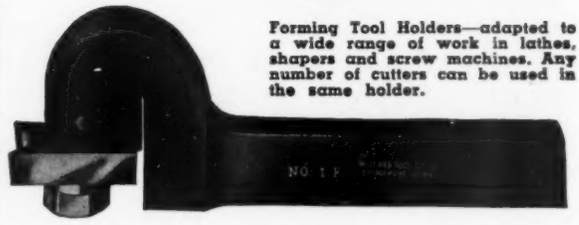
Willard Tool Holders have been specially developed to save time and insure precision on high production repetitive work such as that demanded in shops busily engaged in AUTOMOTIVE, AIR CRAFT and DEFENSE MANUFACTURING.

They are available for a wide number of operations and hold tools securely against chatter. Cutter breakage is eliminated and the possibility of damaged work reduced to a minimum.

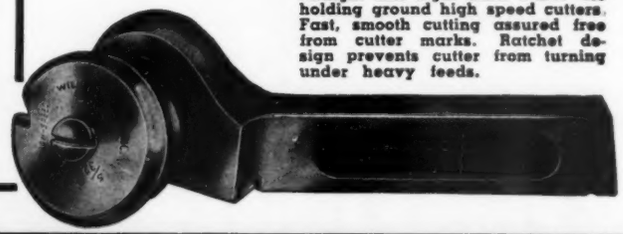
PROMPT DELIVERIES

Write today for descriptive folder which gives details on Willard Tool Holders for Forming, Threading and Forming Tools, Cutting Off Tools and Threading Tools.

Cutting-off Tool Holders reduce cut off time in half over solid tools. Spring feature makes faster feeds and heavier cuts safely possible.

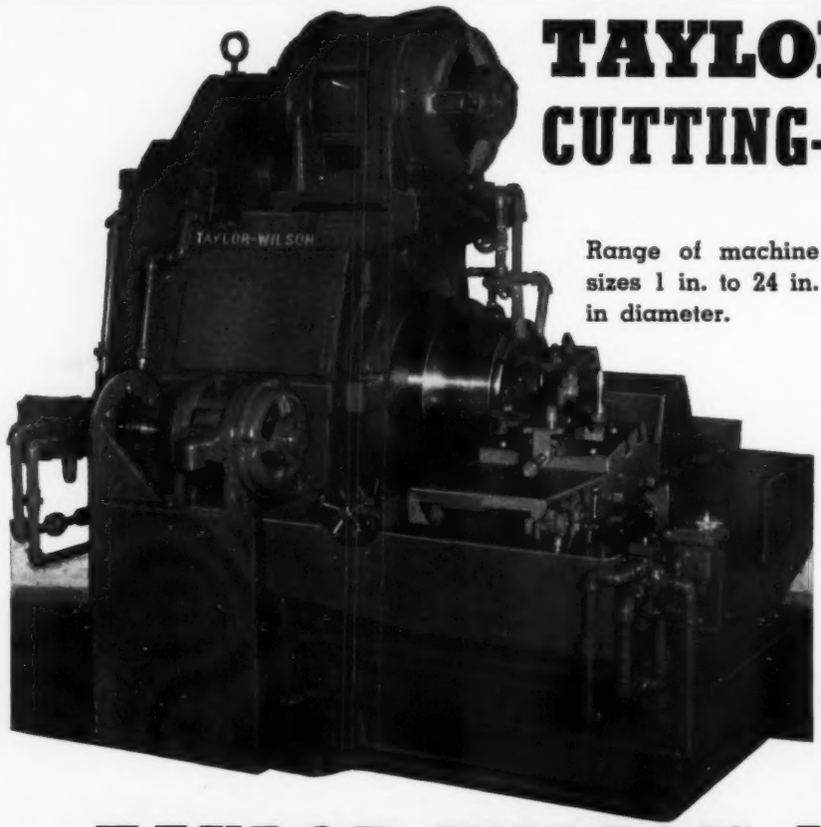


Forming Tool Holders—adapted to a wide range of work in lathes, shapers and screw machines. Any number of cutters can be used in the same holder.



Forming Tool Holders — with straight and right hand offset—for holding ground high speed cutters. Fast, smooth cutting assured free from cutter marks. Ratchet design prevents cutter from turning under heavy feeds.

WILLARD TOOL DIVISION
AUTO-ORDNANCE CORPORATION
1437 Railroad Avenue — Bridgeport, Conn.



TAYLOR-WILSON CUTTING-OFF MACHINE

Range of machine sizes 1 in. to 24 in. in diameter.

for Bomb Blanks, Coupling Stock, Roller Bearing Blanks, etc.

Built to give maximum speed and close tolerance in cutting set lengths. Uses all grades of steel tubing, including N-80 seamless tube. Taylor-Wilson machines are giving unparalleled, continuous service in war production industries.

TAYLOR-WILSON MFG. CO.
35 THOMSON AVE. (Pittsburgh District) McKEES ROCKS, PA.

SMASH THIS BOTTLENECK!

USE *Atlas* LATHES
WITH TURRET ATTACHMENTS FOR
SMALL SCREW MACHINE WORK

ATLAS PRESS CO., 604 N. Pitcher St., Kalamazoo, Mich.

Atlas
ATLAS PRESS CO.
KALAMAZOO, MICH.
U. S. A.

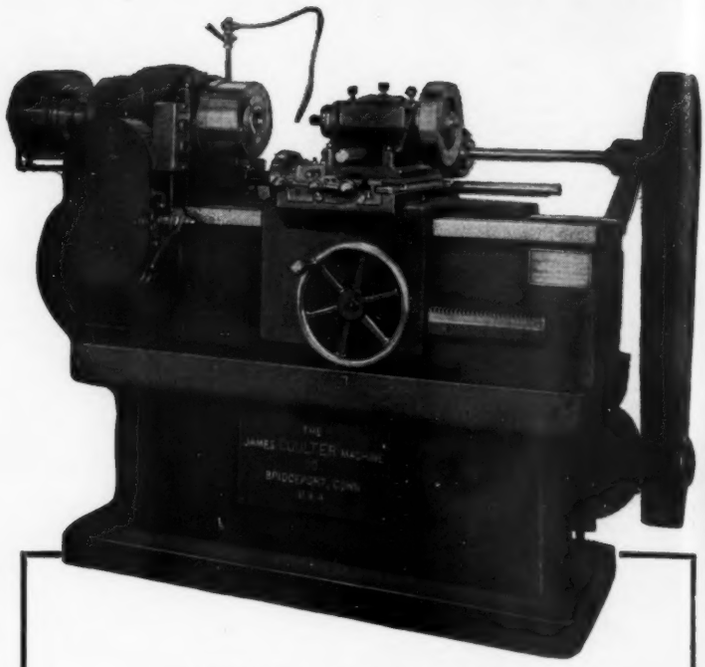
F-Series 10 inch LATHE
equipped as TURRET LATHE for rapid production of small parts

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER Machine Co.
BRIDGEPORT · CONNECTICUT · U.S.A.

LOOK at the ARROWS

STURDIMATIC
High-Speed, Heavy-Duty
LIVE CENTER

- Eliminate "Dead Center" friction.
- Rotate free and easy on ball bearings.
- No distortion of center hole.
- Eliminate chatter.
- Minimum overhang.

. . . they point to where the

STURDIMATIC CENTER

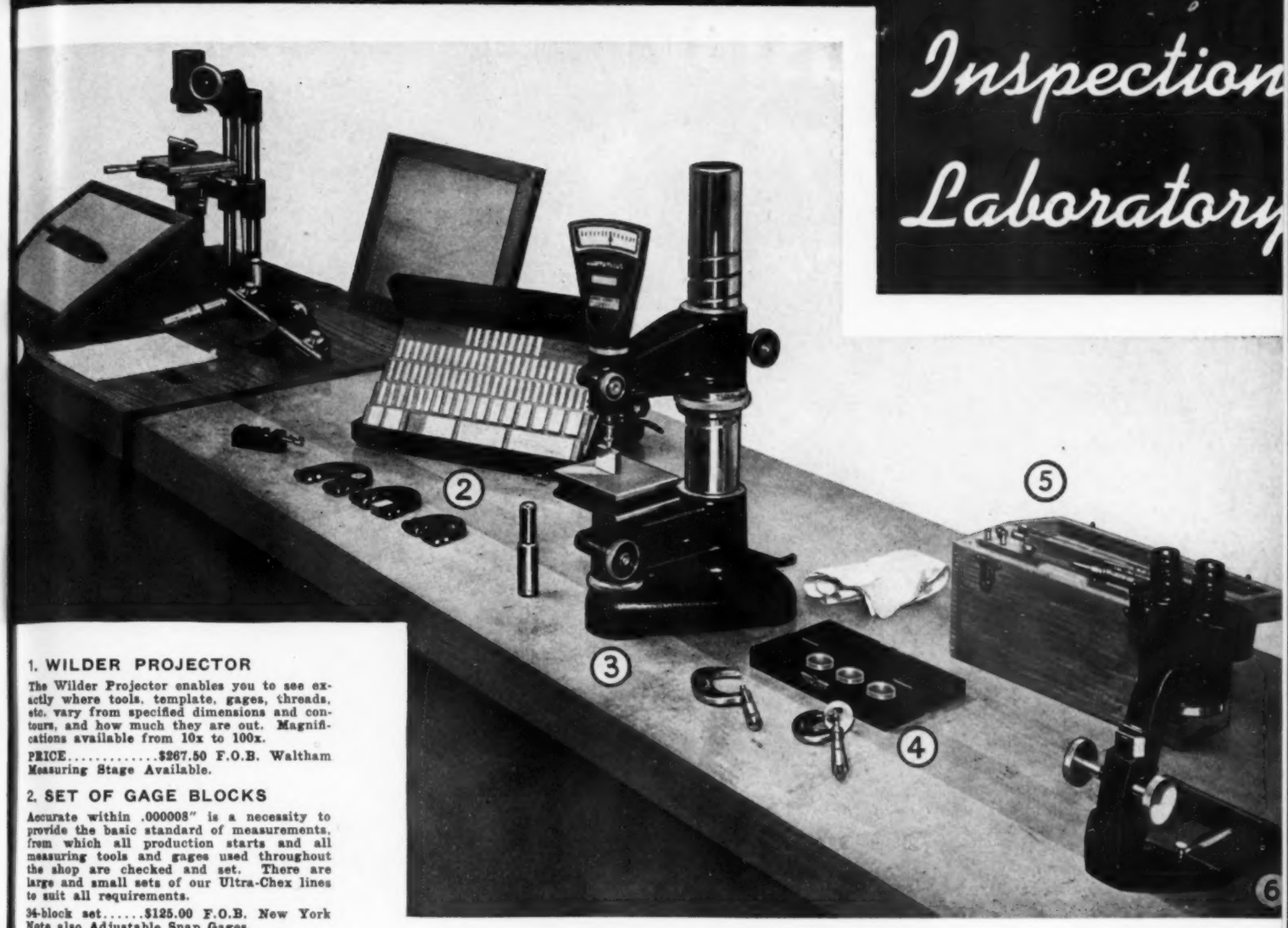
Provides Vital Cushioning. This Protects the Bearings from Shock Loads and Thrust Overload Due to Expansion of Work Produced by Heat from Machining.

STURDIMATIC TOOL CO. ★
5214 THIRD AVE. DETROIT, MICH.

Write for New Illustrated Folder giving complete technical details, specifications, sizes and prices. Standard sizes from stock.

The SCHERR LIMITED BUDGET

Inspection Laboratory



1. WILDER PROJECTOR

The Wilder Projector enables you to see exactly where tools, template, gages, threads, etc. vary from specified dimensions and contours, and how much they are out. Magnifications available from 10x to 100x.

PRICE.....$267.50 F.O.B. Waltham
Measuring Stage Available.

2. SET OF GAGE BLOCKS

Accurate within .000008" is a necessity to provide the basic standard of measurements, from which all production starts and all measuring tools and gages used throughout the shop are checked and set. There are large and small sets of our Ultra-Chex lines to suit all requirements.

36-block set.....$125.00 F.O.B. New York
Note also Adjustable Snap Gages.

3. SCHERR COMPARITOL

Gives accurate dependable readings in 1/10000". Gage blocks, plug gages, tools are checked for size, tolerance and wear. Mass produced parts such as bearings, pins, bushings, are rapidly checked without dependence upon the skill or "feel" of the operator.

Standard size 0—6"..$195 F.O.B. New York
Heavy-duty 0—8" size $250 F.O.B. New York

4. OPTICAL FLATS

Required to inspect the surface of gage blocks, lapped surfaces of all kinds and parallelism of micrometer anvils.

2" Optical Flats.....$25.00
2½" Optical Flats.....$35.00
Single Optical Parallels.....$10.00

5. REED PRECISION MICROMETERS

1" and 2" in 1/1000" and with vernier to 1/10000".

Write for Folder

6. SPENCER BINOCULARS MICROSCOPE

With three dimensional vision reveals scratches, surface finish, imperfections, which cannot be seen with ordinary microscopes shewing one plane of vision $154.25

7. ATLANTIC ADJUSTABLE LIMIT SNAP GAGES

Our snap gages are made to American Gauge Design Standards. Frames are made of MEEHANITE, a special material chosen because it retains its form. These gages are being used in government arsenals and numerous other plants.

Write Today for Folder
QUICK DELIVERY ON MANY SIZES

SAFEGUARD YOUR PRODUCTION FROM THE SCRAP PILE

QUICK production is not your only problem. Machine tools may be speeded up, hours saved by better set-ups, overtime and extra shifts may be installed. Yet this will be of no avail or benefit to anyone if the accuracy of your product is lost with your material ending on the scrap heap.

The best investment for any shop is in inspecting tools to detect and eliminate the errors at the source, before they can affect production. Give your men the right tools to measure with. Remember that whether you manufacture to close tolerances of "tenths" or to wide tolerances of plus or minus .002", you must still start with the basic accuracy in tenths of thousands or else your work will not interchange with that produced in other shops. Invest in the Scherr Limited Budget Inspection Laboratory to guard against future rejections, disputes and loss of time, labor and material.

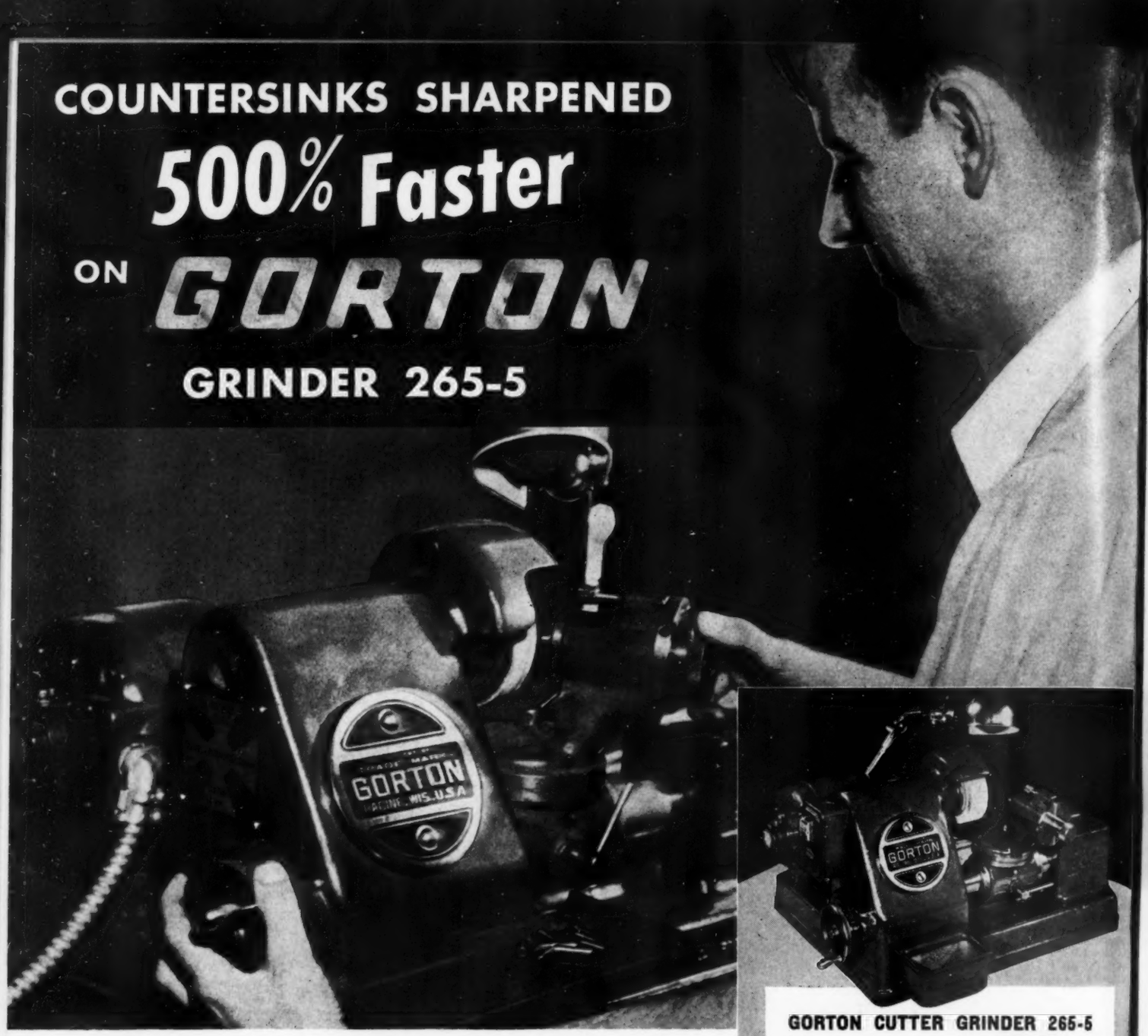
●

Write, wire or telephone Canal 6-1464 for quotation, delivery dates and complete literature.

GEORGE SCHERR COMPANY, INC.

124 LAFAYETTE ST
NEW YORK, N.Y.

COUNTERSINKS SHARPENED
500% Faster
ON GORTON
GRINDER 265-5



GORTON CUTTER GRINDER 265-5
With Collet Type Tool Head 276-1
Price Complete **$196.00**

For precision grinding, single flute cutters—an accurate tool of best materials and workmanship. Equipped with cartridge type precision spindle—hardened and ground. Write for complete data as offered below.

GRINDING TIME CUT FROM 50 TO 10 MINUTES

A prominent machinery manufacturer (name on request) now sharpens single flute countersinks in one-fifth the time formerly required. This is typical of savings in time made possible with the Gorton 265-5 Grinder.

Special angle countersinks formerly sharpened in 45 to 50 minutes are now completed in only 8 to 10 minutes on a Gorton 265-5 Grinder.

The grinder is mounted beside a Gorton 3-U Engraver, and in-between-job time of the operator is profitably consumed in sharpening drills and special countersinks for various shop departments, as well as the engraving tools.

It is also used for sharpening carboloy tipped drills for drilling cast iron and many other small jobs where fine accuracy and fast production is desired.

This Grinder is an accurate, inexpensive tool for fast, precision grinding of single flute cutters. It is also used for grinding extremely sharp pointed punches. Interchangeable tool heads are available for a wide range of work.

COUNTERSINK GRINDING DATA

MACHINE—Gorton Cutter Grinder 265-5.
PART—Special Countersink.
MATERIAL—High-Speed Steel.
GRINDING WHEEL—4" Dia. with 1½" Hole.
OPERATION—Grind Point.
HOLDING—Collet Type Tool Head.
GRINDING TIME—8 to 10 Min.

FREE CATALOG

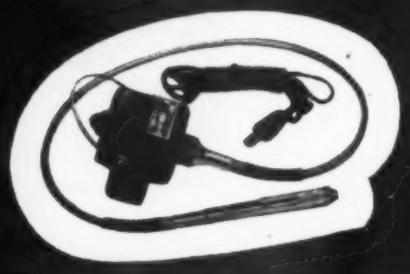
. . . contains complete data and specifications covering Gorton Accessories, Cutters and Grinders. Write for Catalog 1317-D.

GEORGE GORTON MACHINE CO.

1315 RACINE STREET, RACINE, WISCONSIN, U.S.A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

PREVENT BOTTLENECKS AT POINTS OF FINAL ASSEMBLY



USE

FOREDOM'S MODEL 111 *Flexible Shaft* GRINDER KIT

No need to discard costly parts which do not match up when they come to final assembly. Have one of these versatile "pinch-hitters" handy to remove burrs or touch up parts which have slight imperfections. Their modest cost makes it possible to place one at each point of final assembly.

HUNDREDS OF USES WITH MODEL 111
Truly Industry's "FIRST-AID" Portable Grinder

The pencil-size handpiece makes this tool indispensable in any plant. Gets to hard-to-reach places . . . time and again saves an expensive disassembly and reset . . . has dozens of tool-room and maintenance uses . . . affords precise finger-tip control . . . keeps work well in view.

SPOT MODEL 111 AT CONVENIENT POINTS ABOUT YOUR PLANT

PROMOTE EFFICIENCY and save steps by spotting Model 111 Kits at convenient points about your plant. Many will be the times they'll "save the day."

3-WAY USABILITY

Use it at the bench—suspended from any convenient hook—or slung from the shoulder by slipping a strap through motor hanger.

At its low cost, Model 111 frequently pays for itself on one job. Complete with case and accessories **$23.50**

Order Foredom 111 from your Supply House

FOREDOM
ELECTRIC COMPANY
27 Park Place, New York, N. Y.

Most Complete Line of Light Flexible Shaft Machines

Foredom Electric Co., Dept. 349
27 Park Place, New York, N. Y.

Gentlemen, please send me complete information on your Model 111 Flexible Shaft Grinder Kit. No obligation, of course.

Name .....

Company .....

Address .....

City ..... State .....

The giant "Pencil Sharpener" that grinds out projectiles!

Imagine a machine that grinds out 37-mm projectiles almost as easily as you'd sharpen a pencil! Getting the precision of form and finish necessary for accurate shooting was once a much slower procedure. But that was before Carborundum helped develop the wheels for centerless grinding of projectiles. Now the process is simple. First, slice off a piece of cold rolled steel bar stock to exact length with an abrasive cutting off wheel, turn the nose to approximate profile and heat treat to required hardness. Then feed this piece between the specially shaped wheels of a centerless grinder...and...out pops a projectile!

Centerless grinding is performing hundreds of operations in a fraction of the time previously required. And Carborundum has led in developing centerless grinding wheels, which are speeding the output of valves, pistons, shafts, and other products necessary to win the war.

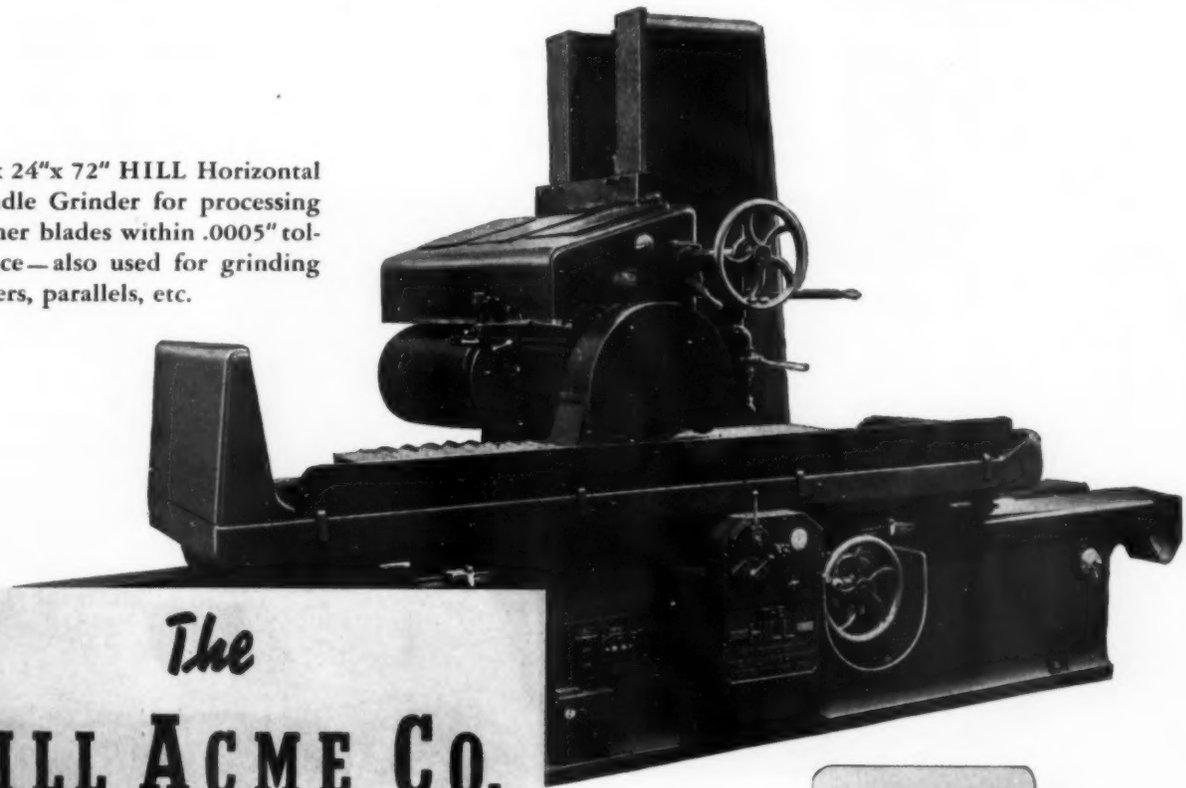
At Carborundum, all our energies are centered on the single objective of helping industry do a better job through the better use of abrasives. Our facilities and experiences are at your disposal. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM
REG. U.S. PAT. OFF. BRAND
ABRASIVE PRODUCTS

Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company

●● BOUGHT BY A MAN with foresight

By actual performance, this HILL Horizontal Spindle Surface Grinder has convinced the purchaser that it meets his *immediate* needs for increased production in rough and finished grinding operations. He also recognizes that the Advanced Design and Permanent Accuracy of the HILL "Open Side" Heavy Duty Grinder makes it a valuable addition to his *future* machine tool requirements. The advantages of this long range buying program are obvious—HILL Grinders should be carefully considered for your present and future needs.



30"x 24"x 72" HILL Horizontal Spindle Grinder for processing reamer blades within .0005" tolerance—also used for grinding cutters, parallels, etc.

The

HILL ACME CO.

6400 BREAKWATER AVE. CLEVELAND, OHIO

HILL *"Open Side"* Surface Grinders are built in both Horizontal Spindle and Vertical Spindle types in a full range of sizes with table dimensions 18", 24", or 30" wide and 5 to 20 feet long.

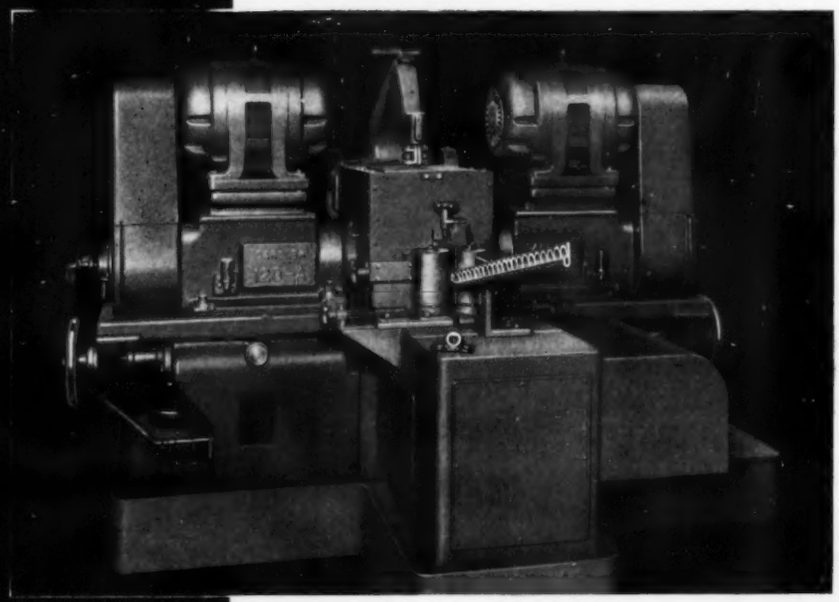
★ ★ ★ ★ **ALSO BUILT IN VERTICAL SPINDLE DESIGN** ★ ★

What's YOUR grinding job— *parallel-surface parts* like this?

IF SO, you should investigate the possibilities of Gardner DOUBLE-DISC Grinding.

For example, the steel thrust washers having parallel faces of UNEQUAL area, shown here, are ground, two sides simultaneously, on a Gardner No. 120A-23" Double Spindle Grinder, using a "push-thru" fixture with a rubber-roll feeding attachment. The parts are supported, during grinding, on steel guide bars which extend through the machine between the abrasives, and are fed in a constant stream, dropping out at the rear. Ample coolant is used, and excellent finish and accuracy are obtained.

PRODUCTION, on washers approximately 2" O.D. x 1¼" center hole, averages 30 per minute, holding within .001" for flatness and parallelism, and .002" for uniformity.



Gardner Double-Head Grinders, carrying heavy-duty WIRE-LOKT Abrasives (see illustration below), will turn out YOUR parallel-surface jobs with similar results.

Write for data on DOUBLE-DISC GRINDING!

GARDNER MACHINE CO.

410 East Gardner St., Beloit, Wisconsin, U. S. A.

"Gardner—Grind Your Flat Surfaces"

Six Time and Money Saving Reasons Why It Will Pay You To Install SUNNEN PRECISION HONING

1. ***Inexpensive*** . . . The basic price of the Sunnen Precision Honing Machine is only $195. Operating costs are correspondingly low.

2. ***Accurate — Super-Smooth Finish*** . . . Accuracy within .0001″ is guaranteed —has often been held to .000025″ in production work. Finish often held to 2 to 3 micro inches.

3. ***Does Not Require Skilled Labor*** . . . Workers in "teens" can handle jobs in "tenths" after a few hours' instruction and practice. In many plants Sunnen Hones are operated by girls.

4. ***Relieves Big Internal Grinders*** . . . Range of .185″ to 2.400″ makes it possible to handle many important small jobs which in the past had to be run on large internal grinders.

5. ***Doesn't Need Fixtures*** . . . Work is held in hand by operator — no fixtures necessary.

6. ***No Set-Up Time*** . . . Machine can be set up for any job within its size range in less than one minute. Size adjustment can be made with machine in motion and work on mandrel.

Write for FREE BULLETIN

WRITE for Free Bulletin giving complete data. Or, if you prefer, a Sales Engineer will call and demonstrate machine in your plant on your job.

★Manufacturers throughout the war industries are amazed to find that such an inexpensive machine can produce such accurate work at so low a cost.

In our constant effort for more and MORE PRODUCTION of vital war materials, the Sunnen Precision Honing Machine is playing an important part. In plant after plant it is showing production increases of from 100% to 500% with corresponding reduction in costs.

Corrects errors of out-of-roundness and taper caused by previous operations. Finishes holes to close tolerances both as to size and straightness. Maintains alignment established by previous operations. Provides simple, low cost method for duplicating sizes.

Put Sunnen Precision Honing to work in your plant.

SUNNEN PRODUCTS COMPANY

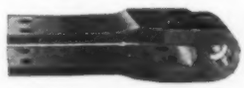
7941 Manchester Avenue St. Louis, Missouri

Canadian Factory: Chatham, Ontario

SUNNEN

Aluminum Aircraft Link "produces high finish without bell-mouthing."

Better finish and alignment maintained on yoke for compressor.



Mild Steel Clevis Honing was used to correct errors of previous machining and maintain true alignment of the two bearing surfaces of this clevis.

Hardened Steel Inner Bearing Race honed to .00005″ limit. Surface finish improved; errors of out-of-roundness eliminated.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

SELECT THE RIGHT WHEEL

AND SAVINGS WILL FOLLOW

Vitrified makes it possible to standardize on grinding wheels by offering a wide range of standard types which cover practically all wheels used on standard makes of grinding machines.

Selection of the right wheel for the work to be handled is simplified in the Vitrified catalog—a 65-page booklet which gives specific data, dimensions, etc., covering the entire Vitrified line.

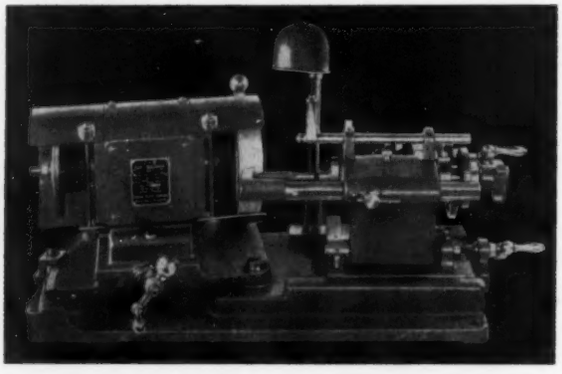
Send for this catalog. Choose a grinding operation in your shop on which you would like to cut costs. Select the Vitrified wheel which meets your specifications, try it out, and compare results with the method formerly used—and you, too, will join the long list of progressive manufacturers which have standardized on Vitrified.

Write for the catalog today

VITRIFIED

VITRIFIED WHEEL COMPANY
WESTFIELD MASS.

DON'T LET YOUR TAPS GET DULL



Keep 'em Sharp

ON THE

J-B TAP GRINDER

No longer is it necessary to discard taps for lack of a rapid, low cost method for accurate chamfer grinding. The J-B TAP GRINDER will do the job by grinding uniform relief on the chamfer of every land. It will grind right- and left-hand taps with 2, 3, 4, 5, 6, 8 and 10 flutes. Capacity—No. 0 to 2". There are no cams to change—no cams to wear, yet the amount of relief may be changed easily.

Many other tools may be ground to advantage on the J-B TAP GRINDER, especially countersinks. Time and tools are valuable—send the coupon today for complete information on the J-B TAP GRINDER.

Please send me complete information on the J-B TAP GRINDER

Name.....

Title.....

Company.....

Street.....

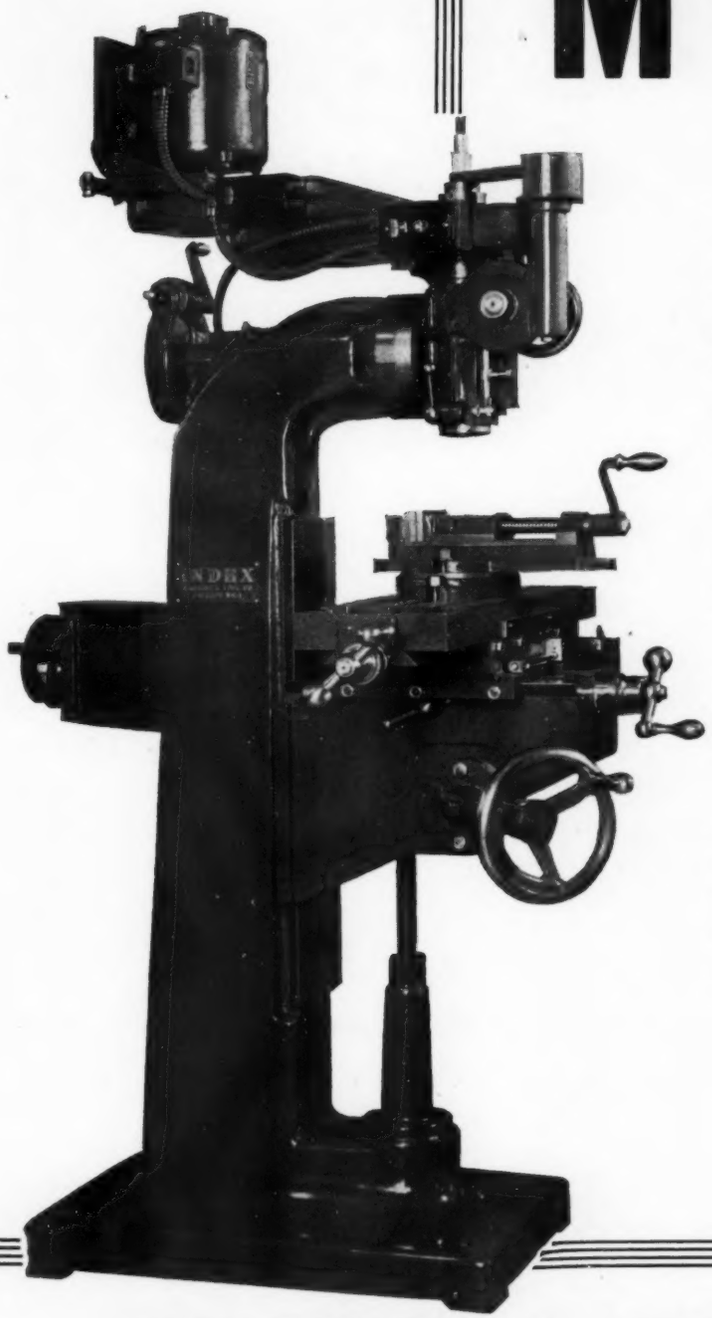
City..... State.....

A.M.

MAIL THE COUPON TODAY!!

EDWARD BLAKE COMPANY 634 COMMONWEALTH AVE. NEWTON CENTRE, MASS.

INDEX MILLS



. . . are attacking mountains of munitions parts with the ferocity of a mosquito boat after an enemy fleet. They are very versatile and are quickly adaptable to production work on the thousands of small precision parts now so vital to our Victory Program.

. . . do end mill work with end mills up to ⅝" in tool steel with amazing speed and accuracy.

. . . will bore a 3" hole in steel.

. . . are equipped with verniers for locating holes and milled surfaces.

. . . have a spindle running in super precision preloaded ball bearings and guaranteed to give ordinary service for a year without any attention.

WRITE TODAY FOR FOLDER AND QUOTATION.

BLANK & BUXTON
MACHINERY CO.

3106 E. MICHIGAN AVE. **JACKSON, MICH.**

ARTER ROTARY SURFACE GRINDERS

finish swivel blocks for Reed-Prentice lathes absolutely flat and parallel. On this job, in common with other parts of the Reed-Prentice lathe there must be a high degree of precision . . . one of many surface grinding jobs that pass over these machines in this plant.

ARTER engineering for surface grinding jobs is at your service.

ARTER GRINDING MACHINE COMPANY

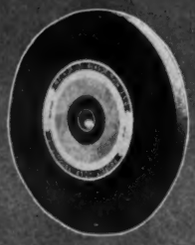
WORCESTER, MASSACHUSETTS • U. S. A.

DO IT FASTER!
DO IT BETTER!
YOU CAN'T BEAT
BAY STATE
Centerless Grinding Wheels
•
Fractional Grades, Controlled Porosity, H9 Bond . . . these three exclusive BAY STATE features give maximum performance. A trial will prove the truth of our statement.
BAY STATE

BAY STATE ABRASIVE PRODUCTS CO.

WESTBORO, MASSACHUSETTS

MACKLIN
GRINDING WHEELS



Are made in ALL sizes and shapes . . . in ALL grain and grade combinations, for EVERY grinding operation.

Macklin Grinding Wheels

will

"PROTECT YOUR PRODUCTION"

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS – JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: – Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

MATTISON

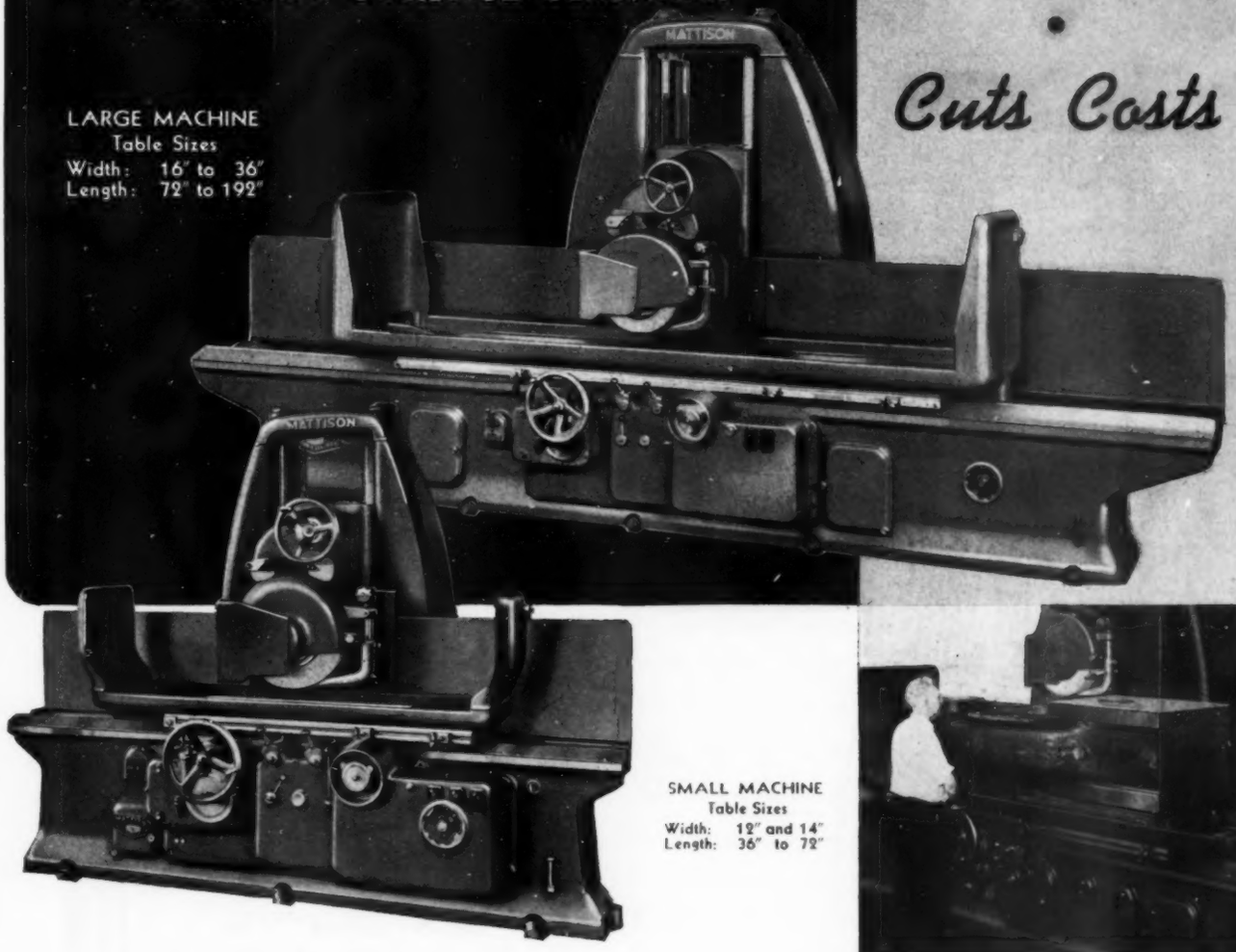
HIGH-POWERED PRECISION SURFACE GRINDER

SPEEDS UP PRODUCTION

•

Cuts Costs

LARGE MACHINE
Table Sizes
Width: 16" to 36"
Length: 72" to 192"



SMALL MACHINE
Table Sizes
Width: 12" and 14"
Length: 36" to 72"

3-ton heading slide formerly hand scraped in 16 hours, now ground in 6 hours on Mattison Grinder.

Caps previously ground few at a time on small grinder. Now Mattison Grinder has reduced time from 7 hours to 30 minutes on quantity shown.

The Mattison High-Powered Precision Surface Grinder has massive double-column support for the wheel head; smooth, rapid, double-cylinder, hydraulic table drive; large capacity; ruggedness of construction and ample power for rapid stock removal.

Here is a great cost-reducing machine which provides precision grinding results on a high production basis. We will be pleased to furnish you with complete details regarding the advantages of the Mattison Surface Grinder as applied to your work.

MATTISON MACHINE WORKS—ROCKFORD, ILLINOIS

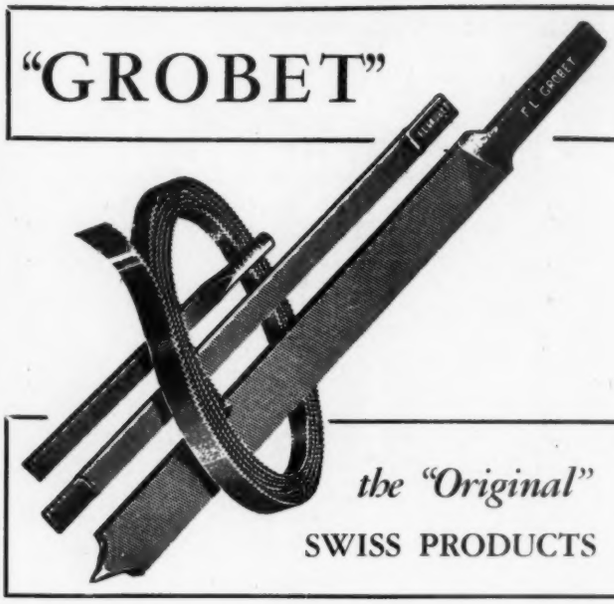
Flexible Shaft Equipment

MORE VERSATILE MACHINES for MORE PROFITABLE WORK

Heavy duty grinding is only *one of many* jobs Haskins Flexible Shaft Equipment will do for you at less cost per man and machine hour. Haskins makes 30 different kinds of equipment—but *each* kind will do *many* kinds of work. See how *you* can apply flexible shaft equipment to more jobs—more profitably. Send for Catalog 45. You'll find it full of valuable information covering grinding, sanding, wire brushing, polishing and rotary filing operations. R. G. Haskins Company, 2760 W. Flournoy St., Chicago, Illinois.

HASKINS *Versatile* FLEXIBLE SHAFT EQUIPMENT

"GROBET"



the "Original" SWISS PRODUCTS

SAVE TIME—ASSURE GREATER ACCURACY IN MUNITIONS MANUFACTURE

An accumulated specialized experience of more than one hundred and twenty-five years in file making assures long service and savings through the use of Grobet Files and Saws. These tools enable modern shops to speed up their production by making faster cuts and maintaining high precision standards.

Every item in the large and extensive complete Grobet line is scientifically right for the service intended. By standardizing on Grobet for all filing and sawing operations you will be able to make many time and labor savings in 1942.

GROBET FILES FOR FILING MACHINES

Highest quality work from filing machines is assured by these precision tools which cut faster and wear longer. Made of chrome steel for maximum hardness and available for all types of filing machines.

GROBET SAWS

Included in the Grobet line are coil and blade style saws with flexible backs. Long service and economy are assured.

GROBET ROTARY FILES

These tools are available in hundreds of shapes. Included are hand cut, milled cut, ground from the solid as well as Die Sinkers' Burs, fully described in Catalog DG.

5000 GROBET SWISS FILES TO MEET EVERY NEED

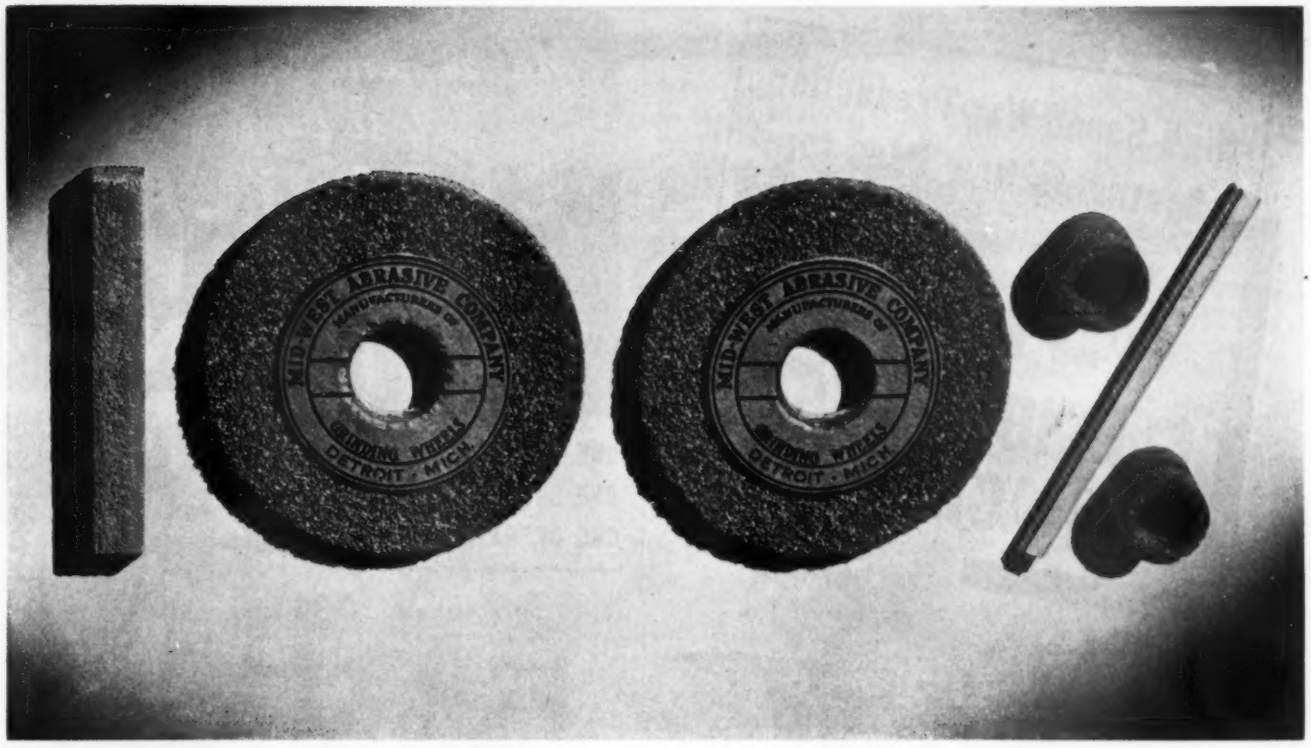
Swiss precision hand files are available in more than 5000 types and shapes in 9 numbers of cuts. Send for a copy of Catalog DF giving complete information.

Ask also for information on Circular Cut Files, Small High Speed Steel Flat Drills, Gravers and Tools.

Grobet File Co. of America

3 Park Place **New York, N. Y.**

GROBET FILES and SAWS



Mid-West

LIKE the English merchant who "Caters to the King," we are proud to announce that virtually one hundred percent of the guns being manufactured for the United States Navy as well as a large majority of those produced for the United States Army are honed with MID-WEST honing stones.

That is a simple statement of fact but to us it means recognition of excellency by our armed forces which more than justifies the many years of research and toil and training that went into development of these highly efficient stones. We contend that we manufacture the world's finest abrasives—honing and superfinishing stones, grinding wheels, emery cloth, sandpaper—and we submit that the selection of MID-WEST stones by our Army and Navy is ample proof of that claim.

The accuracy and fire power of our big guns, as our enemies are learning, are second to none in the world and the MID-WEST ABRASIVE COMPANY is extremely proud of its contribution to that prowess. May our guns continue to fire far and true and potently until those who would destroy our way of living are themselves destroyed conclusively.

MID-WEST ABRASIVE COMPANY

Manufacturers of grinding wheels, sandpaper and emery cloth.

1960 E. Milwaukee Ave. **Detroit, Michigan**

MID-WEST ABRASIVES

High Speed War Production Spotlights New Uses for

STOW FLEXIBLE SHAFT MACHINES

This wartime production is tough! New problems . . . new "wrinkles" and stiff schedules . . . all to be handled at record-breaking speed.

A tough job — yes. But being solved in hundreds of work-jammed shops with Stow Flexible Shaft Machines! In the hands of a good workman, a Stow unit is like a hundred tools in one. Grinding, drilling, sanding, filing, wire brushing, buffing, polishing—working in close quarters and on odd-shaped pieces—can be done speedily and to close tolerances where required. No lengthy set-ups—no unnecessary moving of heavy parts. With Stow, you bring the machine to the job.

Let us prove to you that Stow Flexible Shaft Machines can do a real job on the production line, on maintenance work, and in the toolroom alike. As the oldest manufacturer of flexible shafting in America, we know the full possibilities and uses of this type of equipment—and we will gladly give you the benefits of our 67 years of experience. Just write, stating your problems. No obligation.

STOW
FLEXIBLE DRILL SHAFT
— fits into chuck of electric drill and makes an extension that bends around corners, gets into close quarters, works where a regular drill can't reach. Particularly valuable in the aircraft industry.
Lengths up to 48"—standard length 30". Takes drill any size up to ¼".

EARLY DELIVERIES on all **STANDARD MODELS**

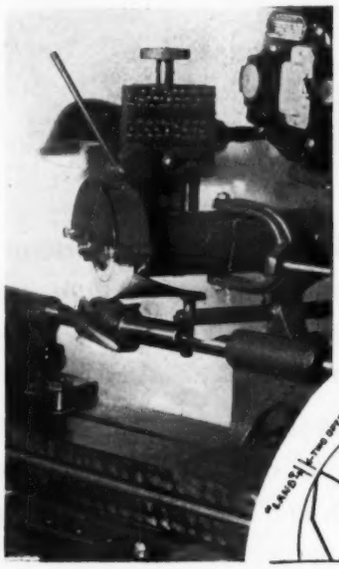
Write today for new Stow catalog

STOW MANUFACTURING CO., Inc.
29 SHEAR ST., BINGHAMTON, N. Y.
Inventors of the Flexible Shaft

Makes your cutting tools last longer

CIRCULAR RELIEF GRINDING

ONE MACHINE
ONE SET UP
ONE OPERATION



COMPARING CONVENTIONAL GRIND WITH CIRCULAR RELIEF GRIND.

●All in a single operation—

Due to the tool being ground with the circular relief exactly the same as the curve of the tool, the outside of the tool remains convex. This leaves all possible metal behind cutting edge for maximum support and gives tool longer life. Here is a compact machine, taking up 2 ft. x 6½ ft. floor space, with 7" swing by 26" long on centers—Motor 110V—60 cycle single phase—that may be plugged in any socket.

Write for catalog.

THE CLEVELAND TOOL ENGINEERING COMPANY
9201 DETROIT AVE. CLEVELAND, OHIO

GRAND RAPIDS ... for close tolerance grinding

Whether your problem is one involving tool room production or tool and cutter grinding, you can depend on Grand Rapids machines for the closest tolerances.

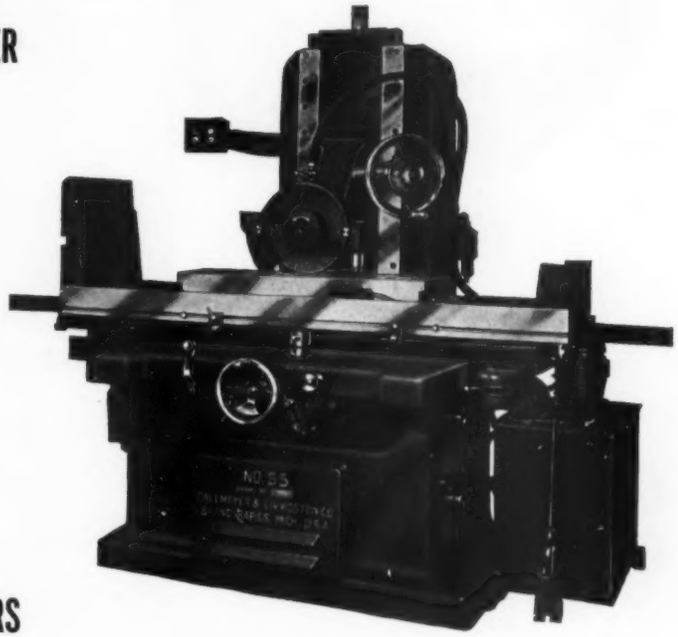
The machines shown here—developed from more than thirty-five years' experience — are typical of those in the Grand Rapids line and can be depended on for your maximum requirements in speed, convenience and accuracy.

No. 55 HYDRAULIC FEED SURFACE GRINDER for tool room and production

Designed to assure the highest possible speed and accuracy, this Grand Rapids machine has a table working surface of 12" x 36", an automatic longitudinal table travel of 38" and a transverse travel of 13½".

Features include the massive, sturdy "Grand Rapids" one-piece column and base, a construction which assures permanent alignment of cross travel and upright head ways. Saddle is a one-piece heavy rigid casting; spindle is mounted on preloaded ball bearings. Hydraulic feed assures smooth work.

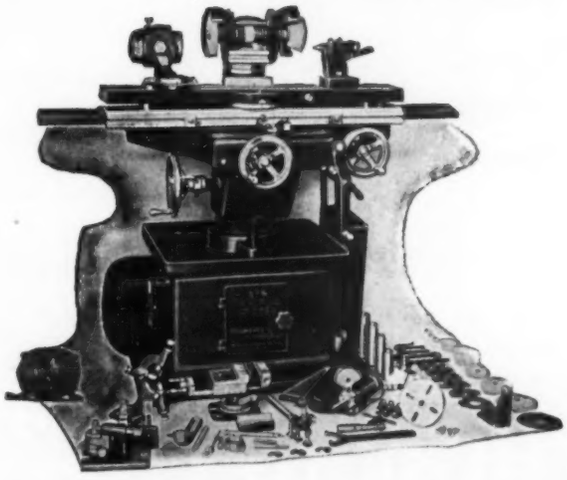
Ask for Bulletin GL-100 describing the full line of Grand Rapids Grinders of this type.



Nos. 4 and 5 TOOL AND CUTTER GRINDERS for perfect tool sharpening

Designed to meet the demand for very high quality machines, these Grand Rapids Universal grinders perform internal, surface and tool grinding quickly, accurately and conveniently. These machines can be operated from either front or rear. Transverse, vertical and longitudinal movements can be made from either position.

Grand Rapids Tool and Cutter Grinders make it possible to perfectly sharpen and insure maximum cutting efficiently of gear cutters, formed cutters, angle cutters, face mills, end mills, side mills, spiral and plain milling cutters, thread chasing tools, reamers, hobbs, etc. Bulletin 3-1-41 gives complete information.

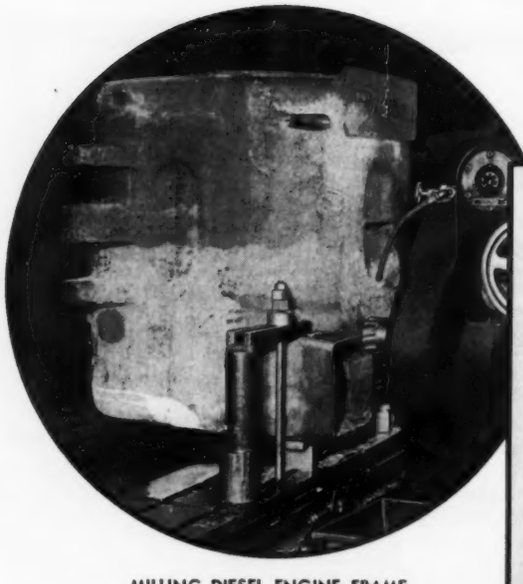


GALLMEYER & LIVINGSTON CO.

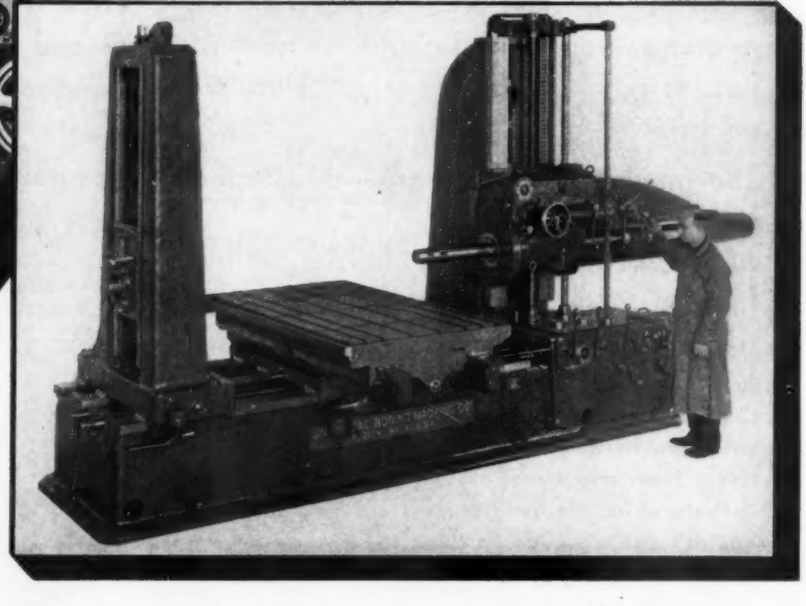
330 STRAIGHT AVE., S.W. GRAND RAPIDS, MICHIGAN

HEAVY WORK HEAVY CUTS—

— TO CLOSEST TOLERANCES ON THE 4-INCH UNIVERSAL BORING MACHINE



MILLING DIESEL ENGINE FRAME FOR SWITCHING LOCOMOTIVE



1. Three Bed Ways — span 44 inches.
2. Table Semi-Box design, heavily ribbed.
3. Motor mounted directly on base.
4. Saddle lead screw nut mounted between guiding ways.
5. Centralized right hand control.
6. Heavy duty type — heaviest 4" spindle machine built.
7. One shot lubrication for head; also for saddle and table assembly.

Pile a good, heavy job on the 4" Universal, then take a husky cut. This will prove the stamina of the machine — especially when the tolerances are close.

A manufacturer of motors for diesel-electric switching engines uses a 4" Universal for face-milling around the air ducts, gear case lugs and brush holder pads on the motor frame.

Full advantage is taken of the Universal TRI-WAY Bed on jobs like this — the load is well distributed — alignment is assured — the work may be moved easily for setting up — or locked securely when under cut.

UNIVERSAL

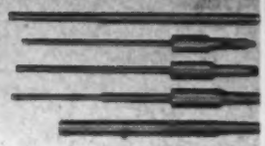
BORING MACHINE COMPANY · HUDSON, MASS., U. S. A.

g tool to form-cut groove on motor gear housing.

Large diameter tool for rough and finish boring and chamfering end of crank case.

Slide action tool to cut face after clearing obstruction in casting.

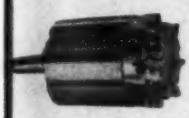
Slide action tool for rough and finish boring, chamfering and facing rear end of crank case.



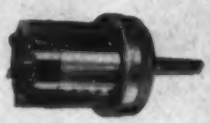
Carboloy tipped boring tools fo machining bearing seats.

ne action tool to turn hub for gear clearance.

Slide action tool for finish facing rear end of motor crank case.



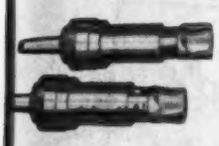
-diameter facing tool equipped removable Carboloy tipped blades.



Facing tool with adjustable serrate blades having staggered Carbolo tips.

equipped with ball bearing micrometer adjustment boring, facing and chamfering bits.

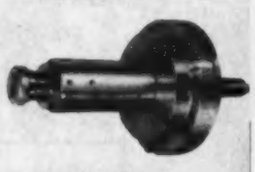
Recessing tool for machining tw grooves for packing rings.



bination Core Drill and finish g tool for use on engine block.

Hollow Mill equipped with adjus able Carboloy tipped blades.

for facing ends of cylinder es after they are mounted in motor block.



Two step facing tool equipped wi adjustable stop and Carbolo tipped blades.

ric facing tool for machining boss thru eccentric opening.

Three chamfering cuts made at sam time on airplane motor casting b this automatic tool.

ing tool for cutting snap-ring groove in gear assembly.

For machining, at one time, two sid of outer bearing in camshaft housing

ction tool to rough and finish chamfer, and face reduction gear housing.

Boring tool with micrometer adjustment for use on distributor gear housing.

Automatic tool for cutting recess and two chamfers in supercharger part.

Recessing tool for cutting double groove in oil line part.

Automatic facing tool for machinin internal boss.

PRODUCTION SPEEDS UP *with* Carboloy TIPPED TOOLS

The illustrations show a few of the many High Production Tools designed and built by Scully-Jones & Company for producing aircraft engines. Carboloy tipped cutting edges assure maximum efficiency in performance as well as increased production through greater speeds and feeds.

Our Engineering Staff is ready to assist in solving your production tooling problems.

SCULLY-JONES & CO.

1901 SOUTH ROCKWELL STREET

CHICAGO • ILLINOIS

116% INCREASE IN PRODUCTION WITH HALF THE MAN HOURS!

SKF Industries, Inc., built this special set-up using 4 standard Walker-Turner Drill Heads. This machine drills 1/8" lubrication holes in inner rings. Formerly, two men, with a single spindle, were needed to load and unload, producing 220 pieces per hour. Now, one man handles four spindles, drilling two holes in each of two rings simultaneously . . . producing more than 350 pieces per hour.

Walker-Turner *Drill Heads* • *for Special Set-ups*

CONSTRUCTION FEATURES

- One-piece head casting, precision bored to assure correct bearing alignment.
- Six-spline spindle runs on four precision ball bearings.
- Pulley straddle mounted between bearings to eliminate spindle "whip".
- O-1-2" Jacobs Chuck or adapter for No. 1 Morse Taper. Spindle travel 3—5-8".

Great increases *in production, valuable savings in time and labor,* are gained by using special set-ups incorporating standard Walker-Turner Drill heads.

Countless combinations are possible because these Drill Heads operate with speed and accuracy in any position—vertical, horizontal, tilted or inverted. All parts are interchangeable, permitting adaptation to practically any needs.

Walker-Turner Drill Heads are available *promptly* for plants engaged in war production. Outline your operation and our engineers will gladly assist in working out a practical tooling set-up.

Walker-Turner Co., Inc. 4562 **Berckman Street** *Plainfield, N. J.*

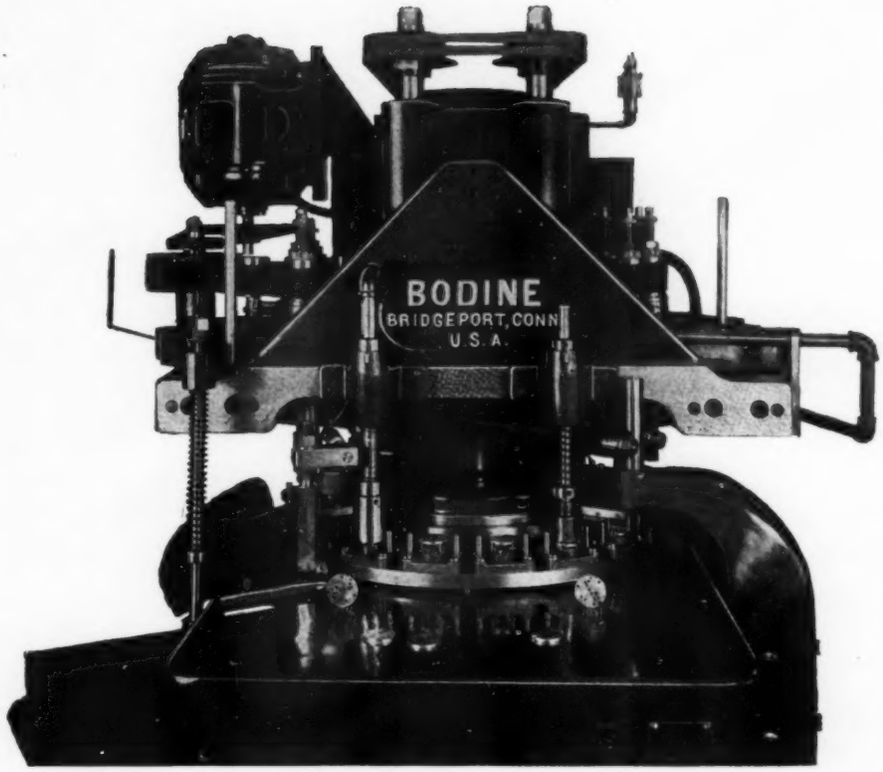
walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

WALKER-TURNER MACHINE TOOLS

FOR METAL, WOOD AND PLASTICS

DRILL PRESSES · BAND SAWS · BENCH SAWS · TILTING ARBOR SAWS · LATHES
JIG SAWS · RADIAL SAWS · RADIAL DRILLS · BELT AND DISC SURFACERS · JOINTERS
SPINDLE SHAPERS · GRINDERS · FLEXIBLE SHAFT MACHINES · CUSTOM BUILT MOTORS

Bodine *Engineers* LIKE JOBS that "CAN'T BE DONE"



Bodine engineers have not only created this multi-purpose machine but they have endowed it with a flexibility so great that it is giving hi-speed production in many vital industries.

Show Bodine engineers a tough job . . . ask them how more and faster operations can be crowded into valuable hours . . . let them adapt this automatic dial principle to your production. Every day they're solving problems that "can't be done".

Bodine does this..

★ Bodine builds 6 sizes of these Automatic dial type machines and develops correct tooling set-ups to perform the operations you require.

★ Flexibility of the Bodine method permits tooling for an extremely wide range of work.

★ Send us your blueprints or samples for our recommendations.

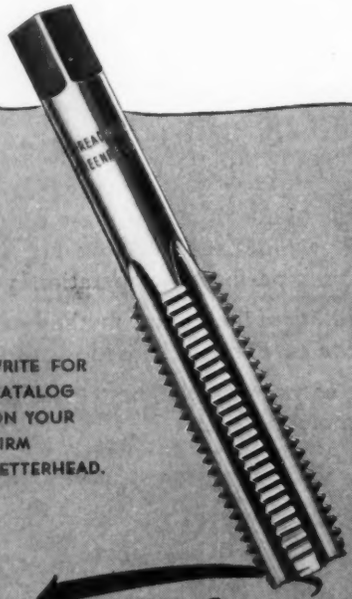
DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

The horizontal indexing table holds the work which is performed in sequence at located stations by vertical, horizontal or inverted tools . . . (one position or all, simultaneously) . . . and ejects the completed part. Spindles are equipped with standard chucks o. collets as desired. Built for light or heavy duty. Speeds up to 20,000 R. P. M. Fully adjustable ball-bearing spindles.

THE *Bodine* CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

Victory hangs on millions of threads



WRITE FOR CATALOG ON YOUR FIRM LETTERHEAD.

Today we are as proud of the names of our customers as we are of the quality of our taps. We know that in their hands our tools will help fashion planes, tanks, ships and arms that will stand up in the racking crescendo of all-out attack. We can ask for no greater satisfaction today than to share in this job.

THREADWELL TAP & DIE CO. . GREENFIELD, MASS.

SALES AGENTS: Canada - BRIDGE MACHINERY COMPANY, Montreal. England - SKYLUX, LTD., London.

Threadwell

THE NEW NAME FOR SUPERLATIVE THREADING

Companions in PERFORMANCE!

"RS" Collapsing Tap — Five sizes — 1-1/4 to 2-13/16" with blade chasers. Larger sizes up to 5" with circular chasers. Shown equipped for stationary spindle.

Yes sir, *ANOTHER* Namco "Double Duty" Tool—

THE NEW "RS" COLLAPSING TAP

Remember — Namco "DR" and "DS" Circular Chaser Dies use interchangeable chasers and are also quickly adapted to hollow milling by substitution of cutters and holding blocks.

By similar economical planning — *One Basic Design* in the new "RS" Tap serves both revolving and stationary spindle machines. Quick and positive opening action, fine diametric adjustment and ground thread chasers offer the same precision and trouble-free production you are now getting from Namco Dies. Ask for proof of this outstanding performance.

"DS" Circular Chaser Die for stationary spindles. Sizes 3/8 to 4-7/8". Readily adaptable to Hollow Milling work.

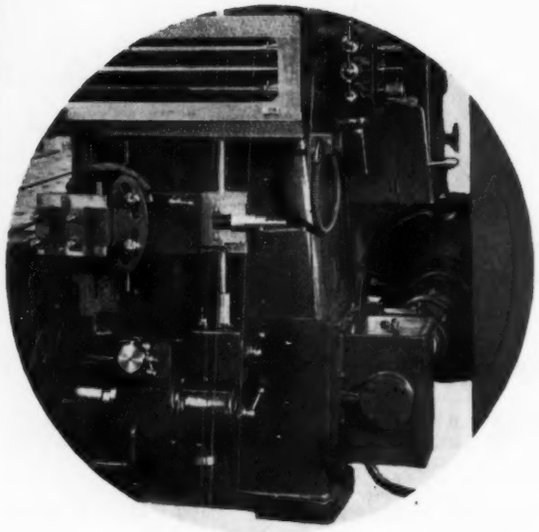
"DR" Circular Cutter Hollow Milling head for revolving spindles. Sizes 5/16 to 4-7/8". May be quickly changed for threading.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

CLEVELAND *Open Side* PLANERS



EASIER OPERATION
HIGHER PRODUCTION
offered in the advanced

"NEW SERIES" CLEVELAND PLANERS

One of the many advanced features of the "NEW SERIES" is the improved DIAL FEED.

This is a *positive* feed. Ranges from 0 to 1" by .010".

Feeds may be increased or decreased and may be changed from beginning to the end of stroke or from the end to the beginning of stroke while planer is in operation.

New operators find this DIAL FEED particularly helpful in maintaining steady, accurate production.

Built in 7 sizes from 26" x 26" to 72" x 72"

The Cleveland Planer

3148 - 3156
SUPERIOR AVE.
CLEVELAND
OHIO

Converting.?

***Local stocks and round-the-clock service of distributors have brought them a skyrocketing share of industry's business in this emergency. For efficient, helpful service,* use your mill supplier!**

● Are you faced with the problem of converting to war production with least possible time and trouble? Do you have to locate new tools, accessories and supplies with least possible delay?

Then use your local industrial distributor. He runs a business normally based on immediate service from stock. Despite present restrictions, he still is allowed to stock available items, because his stock acts as a central stores department for *all local plants.* He is set up to make the promptest possible deliveries to you.

He expects emergencies and accepts them as one way of proving his usefulness to you. He will comb the countryside to get you what you need to keep wheels turning if he doesn't have it in stock.

He is actively searching for surplus tools, supplies and materials which can be put to immediate use—he knows the inside of every local plant.

He is trying to anticipate your requirements—his preferred reply to any request is "We're sending it over right now!"

He'll help you find alternate items if the exact items you want aren't to be had anywhere.

He's an expert at supplying, just as you're an expert in manufacturing.

He's the short cut between you and your requirements for tools, materials and supplies.

He's on the job to get more production, sooner—USE HIM!

Published in the interest of industrial distributors by

MILL SUPPLIES

330 West 42nd Street, New York, N. Y.

SINCE 1911, THE ONLY MAGAZINE SERVING INDUSTRIAL DISTRIBUTORS AND THEIR SALESMEN EXCLUSIVELY

MODERN

COLLAPSIBLE TAPS

will speed up production on your stationary or revolving spindle machines

SPECIAL CHASERS NOT REQUIRED

FOR BOTTOM HOLE TAPPING

•

DETAILS IN BULLETIN M-111

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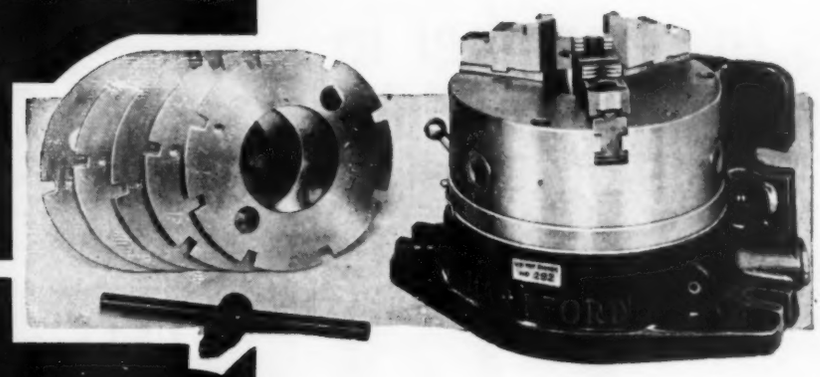
MODERN TOOL WORKS

DIVISION OF CONSOLIDATED MACHINE TOOL CORPORATION

ROCHESTER **NEW YORK**



. . . FOR MAXIMUM PRODUCTIVITY ON INDEXING OPERATIONS

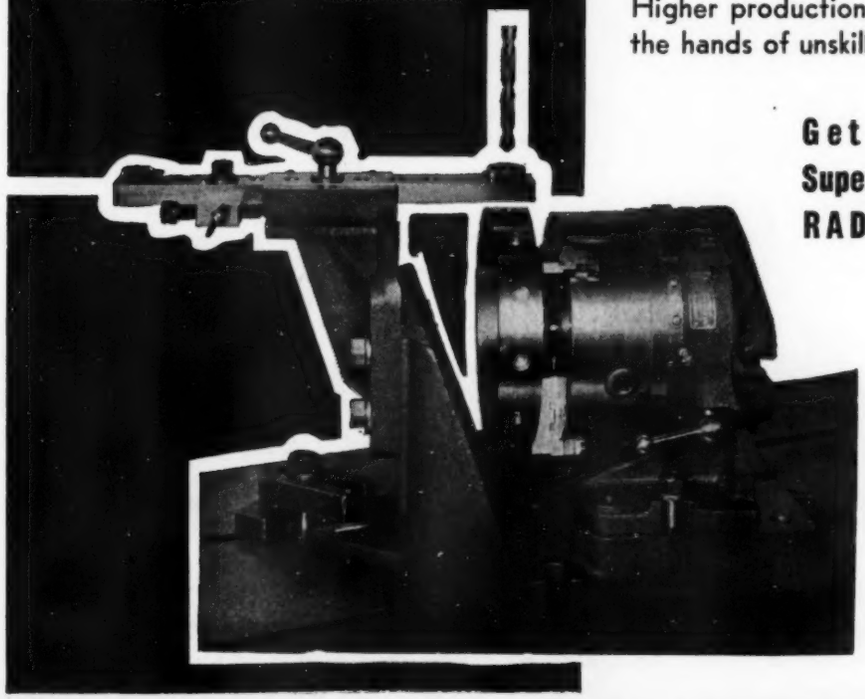
EQUIP YOUR MACHINES WITH THE

HARTFORD SUPER-SPACER

More and better work assured from millers, drilling machines, slotters and planers . . . .

Worthwhile savings in time and fewer rejections are assured with this positive, fast, accurate spacing device. Because the HARTFORD SUPER-SPACER can be depended on to hold work securely, full advantage of higher rates of speeds and feeds can be taken in milling, drilling, slotting and planing operations with a resulting speed-up in production. Mask plates eliminate all chance of error.

The HARTFORD SUPER-SPACER is a time and cost cutter whether used on work involving single pieces or parts in quantity. It quickly pays for itself. Higher production and accuracy are assured even in the hands of unskilled operators.



Get more work out of your Super-Spacer . . with the HARTFORD RADIAL DRILL ATTACHMENT

With this new attachment which is easily secured to the HARTFORD SUPER-SPACER, radial drilling operations can be handled quickly, easily and accurately. Set-up time is practically negligible. Variations in length and diameter are conveniently taken care of.

Explore the possibilities offered by this radial drilling attachment as a means of extending the utility of your SUPER-SPACER.

SEND AT ONCE FOR COMPLETE DETAILED INFORMATION

THE HARTFORD SPECIAL MACHINERY COMPANY

HARTFORD CONNECTICUT

Things to remember in *power* metal sawing!

VICTOR MOLY
U. S. PATENT No 1947020
ONLY THE ORIGINAL MOLYBDENUM HACK SAW BLADES ARE STAMPED MOLY
14x1¼ - .065 - 10 TOOTH
1445 MOLY

Always follow these simple rules—to speed work and conserve the VICTOR Hack Saw Blades you buy:

Take time to select and set up the right blade for the job.
Follow the "three-tooth rule."
Use blades with finer teeth on hard stock and thin sections.
Be sure teeth point in right direction.
Keep blade tight; tighten it after first few strokes.
Use a lubricant, except on cast iron, copper and brass.
Don't use too much lubricant; steam is not a bad sign.
Heat softens teeth and speed makes heat. Keep speed slow, especially on hard stock.
Except on soft or very thin-walled sections, apply all the pressure the teeth will stand without breaking off. As teeth show signs of dulling, increase pressure.
Don't waste time and power on worn blades. When in doubt, replace.
Don't use a new blade in a half-finished cut. Turn over the work.

These helpful hints—and scores more like them—are printed and illustrated in "Metal Cutting", free 20-page VICTOR booklet on selection, use and care of hand and power blades, frames and band saws. Yours for the coupon below.

Victor

VICTOR SAW WORKS, INC.
MIDDLETOWN, N. Y.

Victor Saw Works, Inc., Middletown, N. Y.
Please send immediately ..... copies of "Metal Cutting"—FREE.
Name ..... Title .....
Company Name .....
Address .....
City ..... State .....

2298

COST CUTTING TOOLS

McCROSKY

Tim-E-Cutters

ON MULTI-OPERATION DRILL PRESS JOBS

WIZARD Quick-Change Chuck AND COLLET OUTFIT

WIZARD COLLETS HOLD TOOLS RIGID AND CENTERED

ASK FOR -- McCROSKY BULLETIN 15-D

EST. 1904

McCROSKY TOOL CORPORATION

MEADVILLE, PA.

How a Big Wartime Manufacturer uses his Jobber to keep materials coming in—and recorded

Those Manufacturers who through the years have become really acquainted with their Industrial Distributors, have fared best in getting their War production up to top speed in the shortest time.

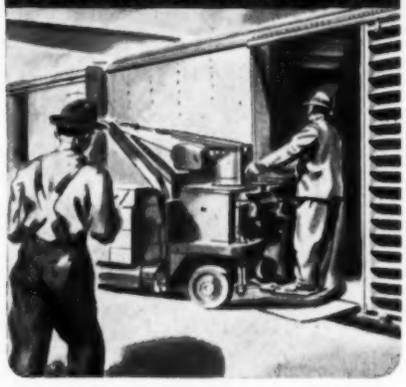
Here is the case of an established Company building, equipping and starting production in a huge new plant—

And the priceless co-operation by his Mill Supply Distributor in establishing an orderly Stockroom when some other Departments were still in confusion:—

ORDERING MATERIAL & SUPPLIES

One copy of each requisition for materials or equipment bought through the Industrial Supply Distributor goes to the salesman as his personal record of each transaction.

CHECKING INCOMING SHIPMENTS



Incoming deliveries of materials requisitioned through the Industrial Distributor are checked upon arrival. The salesman helps with the checking if desired.

STOCK-KEEPING INSIDE PLANT

Distributor's salesmen kept a friendly eye on supplies and helped the Stockkeeper to avoid shortages. *Your* Distributors' men will render this valuable service, too.

Whether *you* need help in the Stockroom or elsewhere, your Distributor's resourceful salesmen know their way around and doubtless can do some other equally valuable job for you.

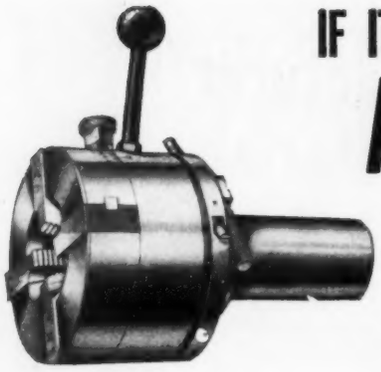
They deserve *your* complete confidence—they earned *ours* long ago. Cle-Forge High-Speed Drills and Peerless Reamers are marketed through Mill Supply Houses throughout Industrial America.

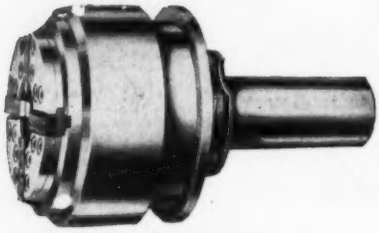
The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

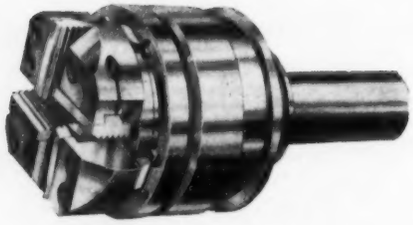
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

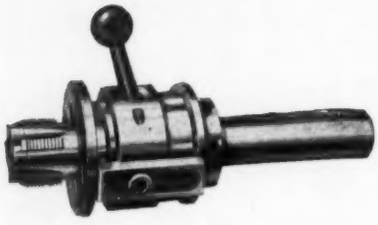
30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD., DETROIT · LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST., E.C.4

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU









IF IT'S ACCURATE SCREW THREADS YOU WANT

Specify GEOMETRIC

Here are a few reasons why you can count on accurate screw threads from Geometric Die Heads, Taps and Threading Machines.

1. You have a wide choice of tools, enabling you to pick one just adapted to the work and to the machine on which the work will be done—you don't have to use a makeshift tool.

2. On external threading you have a wide choice of Chasers—Tangent Chasers, Circular Chasers, Milled Chasers, Tapped Chasers—Where else can you get such a choice?

3. You get Chasers, hardened by experts under closely controlled temperature ranges; you get Chasers that are checked and rechecked until you can be sure they are right; you get the benefits of the experience of a concern that has devoted over 45 years exclusively to the production of tools and machines for producing screw threads.

Self-Opening Die Heads
Solid Adjustable Die Heads
Collapsing Taps
Solid Adjustable Taps
Threading Machines
Chaser Grinder

THE GEOMETRIC TOOL COMPANY

New Haven, Conn.

HOW TO GRIND A RIFLE DRILL BY HAND

NEW, FREE GUIDE Will Help You Grind .30 & .50 Calibre Drills on Your Tool Grinder

This booklet has been prepared for practical shop men and for those confronted, for the first time, with drilling rifle barrels. It covers the four basic operations in grinding rifle drills. It is written in simple language, and contains 9 illustrations, together with diagrams, giving proper angles for grinding. Unskilled help with a little practice and proper study of this booklet, should be able to grind rifle drills for efficient drilling of .30 and .50 calibre rifle barrels. Although we do not manufacture rifle drills nor grinders we have supplied many manufacturers with rifle drilling machines. This booklet was originally planned to assist our machine demonstrators in servicing these machines and is offered to you in the interest of better production of rifle barrels on your present drilling equipment.

FREE: *Rifle Drill Grinding Guide*

Write for this practical guide today. Use it to teach a simple grinding method to unskilled help. Keep it handy as a reference. It will help maintain production on rifle barrel drilling. Ask for as many as needed for your plant. Write for Bulletin A.M.G.

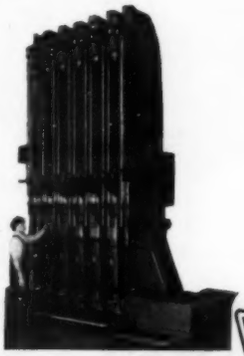
W. F. & JOHN BARNES .30 AND .50 CALIBRE RIFLE DRILLING MACHINES

Included in our extensive line of Gun Drilling, Boring and Reaming machines are the two and six spindle machines as described below. If interested in similar machines for larger gun tubes, write for our *complete* set of bulletins.

NO. 410—2 SPINDLE HORIZONTAL

This machine was designed primarily for rifle barrel drilling, but is equally adaptable to diametrically balanced parts such as cam and crankshafts, boring bars etc.

FREE BOOKLET: Write for bulletin A.M.-410.



SIX SPINDLE VERTICAL RIFLE DRILLING MACHINE

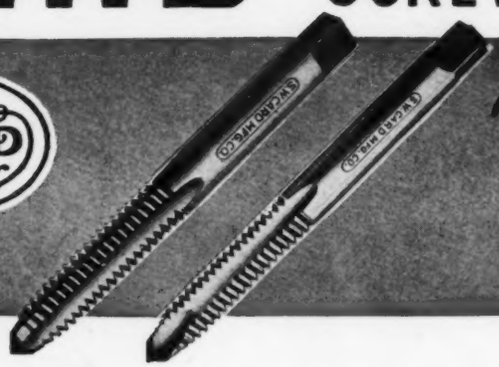
This machine is essentially a unit, designed to drill rifle barrels within a minimum of floor space. Six barrels are machined simultaneously.

FREE CIRCULAR: Write for complete information and specifications. Ask for bulletin A.M.6.

W. F. & JOHN BARNES

ROCKFORD ILLINOIS

CARD MACHINE SCREW TAPS



The CARD Quality

Buy them and put them to work

Carbon and High Speed Steel

Manufactured in Regular Type in 2, 3 or 4 flutes according to size and in Spiral Pointed Type in 2 flutes.

Both Regular and Spiral Pointed Types are furnished with National form of thread. Regular Type furnished in taper, plug or bottoming styles; Spiral Pointed furnished in plug style only. Furnished in Carbon, High Speed cut and High Speed Ground Thread.

Put Card Machine Screw Taps to work and their performance will convince you of their economy. You'll find sizes listed in the Card Catalog No. 34, pages 32-37. Circular covering recommended uses available on request.

Leading dealers carry the Card line

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO

STORES: New York: 61 Reade St., Chicago: 11 S. Clinton St.
Detroit: 6540 Antoine St., San Francisco: 121 Second St.
Seattle: 568 First Avenue, South
Los Angeles: 524 East Fourth Street

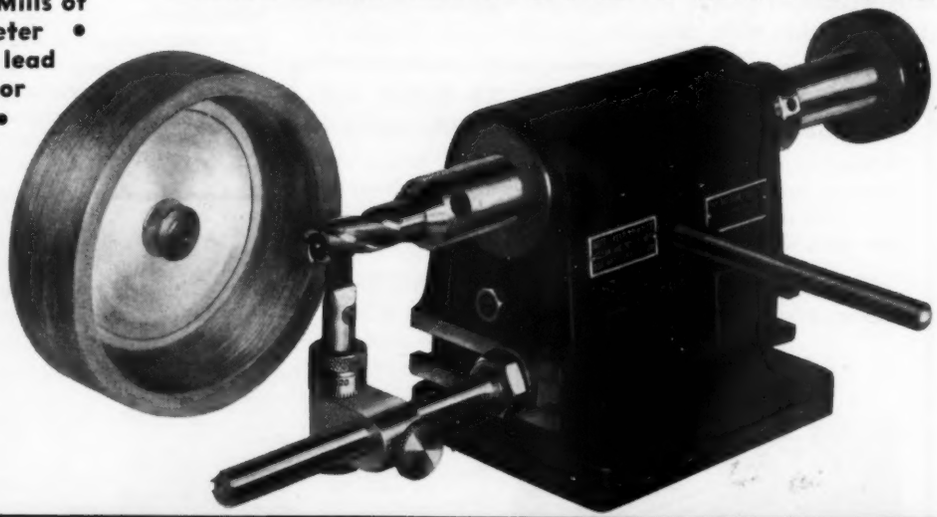
END MILLS ARE SCARCE...MAKE 'EM LAST

Use your WELDON SHARPENING FIXTURE

COMPLETE!
SELF-CONTAINED!

Quickly re-sharpens End Mills of 3/8" to 1 1/4" shank diameter • Requires no centers or lead cams • Releases major production equipment • Designed for any grinder with flat table • No table movement necessary • Operated by trained or unskilled workers • Provides tool conservation — a vital war factor.

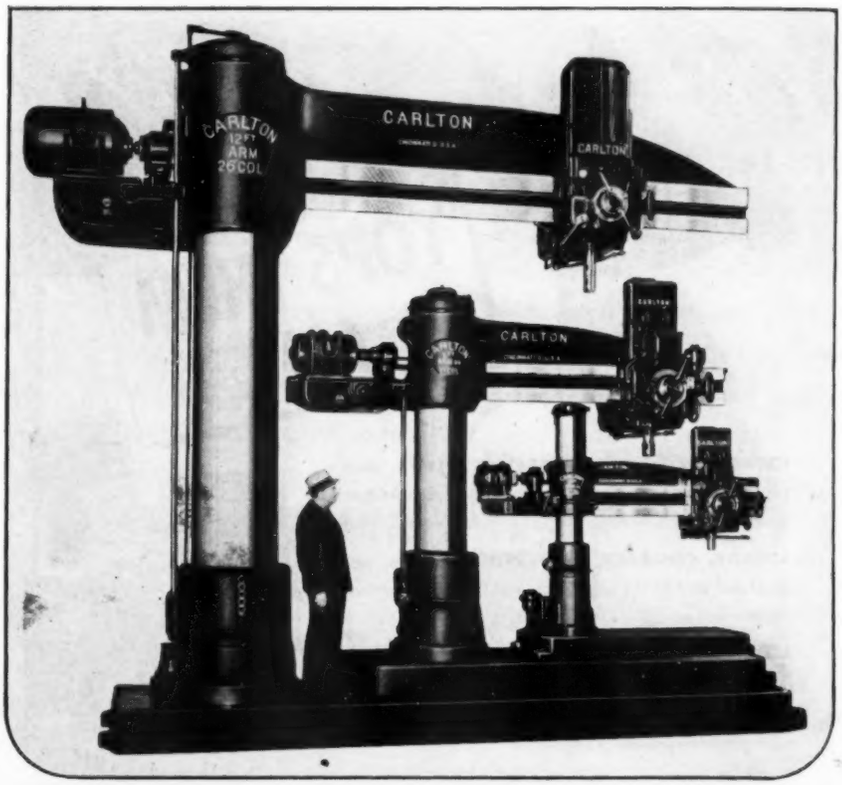
SIMPLE!
CONVENIENT!
FLEXIBLE!



THE WELDON TOOL CO.
3002 WOODHILL ROAD • CLEVELAND, OHIO
"Yesterday's Pioneer — Today's Leader"

END MILLS • GROUND CIRCULAR AND FLAT FORM TOOLS • SCREW MACHINE CAMS • "TU-LIP" COUNTERBORES

CARLTON'S CONTRIBUTION TO SPEEDING-UP DEFENSE . . . .



• Since 1938 Carlton has increased its floor space 180%—and has used 25 outside sources for Machine work but all assembly of all units is completed at the Carlton Plant

Carlton has—

increased productive hours over 100%

increased personnel 400%

Carlton has also been on a 3 shift, 24 hour a day schedule, 7 days a week for the past 24 months.

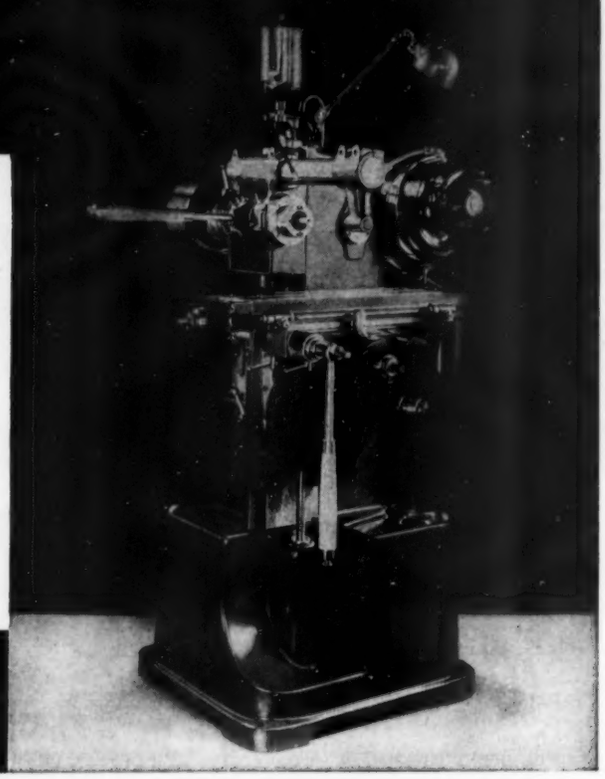
Add this up and you have Carlton's answer to speeding up production to date.

THE CARLTON MACHINE TOOL COMPAN

CINCINNATI - - - OHIO

THE NICHOLS HAND MILLING MACHINE

handles a wide variety of parts at high speed and low cost . . . .



This sturdy, versatile, precision machine—the latest development in this type of hand miller—incorporates features which increase its utility and ability to handle a wide variety of operations at high speed and low cost as compared with larger, slower machines.

Because of its ease of set-up, high cutting speeds and maintained precision, together with elimination of unnecessary friction, it is ideally suited to tool room production requirements. In proportion to its price, the "NICHOLS" is considered one of the most productive machine tools in the field. Its wide use in modern shops is outstanding evidence of its indispensability for today's requirements.

CONDENSED SPECIFICATIONS

Longitudinal Feed—10"
Traverse Feed—7"
Vertical Feed of Knee—13½"
Vertical Movement of Head—4½"
Spindle speeds—100, 200, 600 and 1200 R.P.M.

Write for illustrated Bulletin, giving complete information

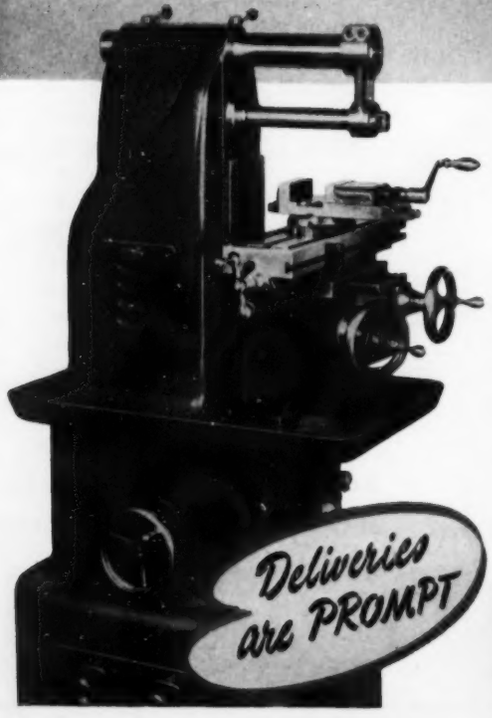
W. H. NICHOLS & SONS

WALTHAM, MASS., U.S.A.

For accurate small part production
For long trouble-free life
For low original investment

Vernon

TOPS THEM ALL!



IDEAL FOR TODAY'S DEFENSE NEEDS—Ample capacity and a wide variety of standard accessories quickly adapt the Vernon No. 0 Mill to hundreds of applications.

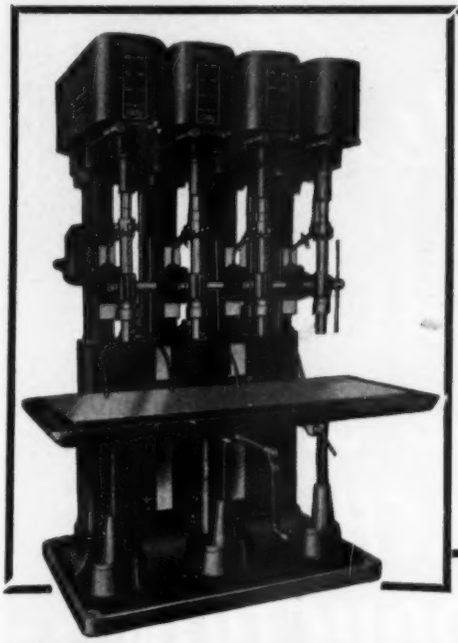
STURDY, COMPACT, POWERFUL—One h.p. motor gives the Vernon the ability to "walk" through the tough jobs as well as today's light alloys.

LOW COST—Vernons are priced so low they have paid for themselves in 30 days.

See the Vernon at your dealer's, conveniently located in all important industrial areas.

Bulletins are available featuring the Vernon Vertical Mill & Jig Borer, Vernon No. 0 Mill, Vernon 11" Shaper and Vernon 12" Shaper. WRITE TODAY!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON LOS ANGELES, CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS



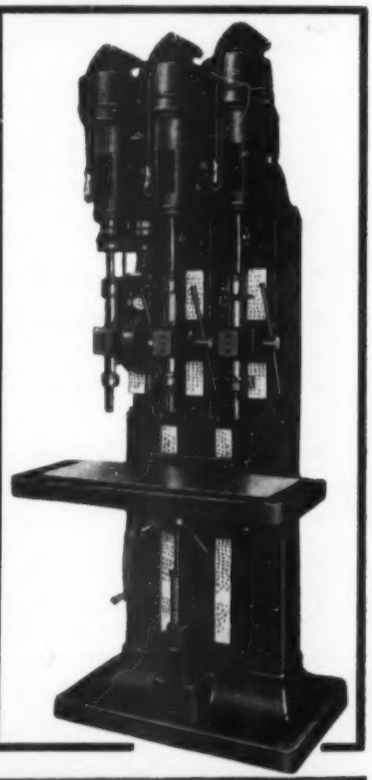
● Between these machines lies a wide range of drilling — tapping — reaming — boring and similar operations—vital to rapid economical conversion to full War programs.

Today in hundreds of plants conversant with War needs Aveys are doing an outstanding job. To those using Aveys and shifting over to an all out War program Avey's offer unlimited possibilities in the flexibility and ease with which standard machines may be adapted to high production of various War jobs.

BELTED-MOTOR-AVEY

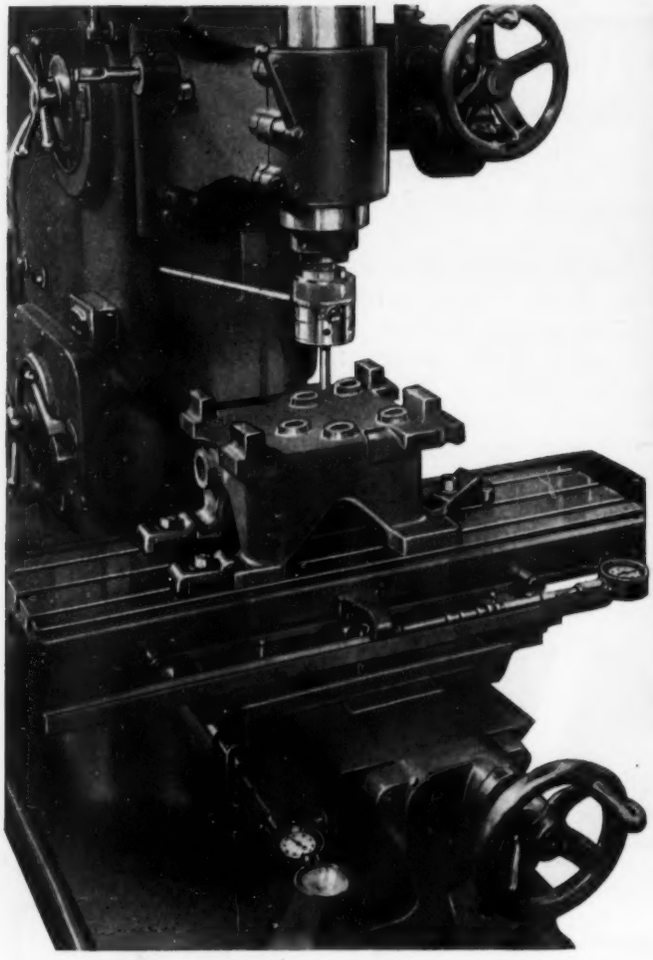
Above is a Four Spindle No. 2 . . . 12" Overhang Hand Feed Machine with individual motor drive and push button control to each spindle. Capacity ⅞" in Cast Iron, 9/16" in Steel. Furnished in Column type from one to eight spindles.

AT THE RIGHT is a Motor-Avey. Three spindle combination machine—1 Aveymatic feed—1 Handfeed—1 Tapper. Type MA-6 —six speed machine with two-speed motor and three mechanical changes through gearing. Push button control. Built in No. 1—No. 2—No. 3 sizes—one to six spindle units, any size.



THE AVEY DRILLING MACHINE CO.
CINCINNATI **OHIO**

Avey DRILLING MACHINES
CINCINNATI · OHIO



A typical jig boring job is done on a KNIGHT Miller. With dial indicators, all five holes were accurately located and bored. At the same setting, the corner pads were milled, insuring squareness with the bored holes.

- Internal and external milling is done at one setting
- Step milling is made easy by getting vertical adjustment on spindle
- Profiling, boring, and slot-milling is all done at one setting
- Precision boring is done, using dial indicators for accurate locating
- Rigid spindle makes possible deep end milling
- Jig boring is possible because of dial indicators
- In experimental work you can machine many jobs completely on this one machine and handle difficult operations without special equipment
- For limited and special production you can keep costs down and maintain quality without special tooling

Wide Range

KNIGHT Millers ADD SPEED TO EACH SHIFT'S PRODUCTION . . .

KNIGHT VERSATILE MILLERS ACCURATE • RIGID

Large work or small—milling or boring, roughing, or accurate finishing cuts—all are handled to equal advantage on this wide range machine. Sixteen changes in speed, in either direction, give the spindle ample range to meet a wide variety of requirements.

Greater speed is realized by users of KNIGHT Millers because of (1) the short time required to make set-ups, particularly difficult ones (2) the elimination of additional set-ups or at least the simplification of them (3) the quick and accurate location of holes and surfaces, especially when dial indicators are used (4) the quick change of vertical settings by moving the spindle instead of the work (5) the fast method of changing cutting tools (6) the swiveling table which greatly reduces the most expensive element in tool room operation—that of time waste in set-up work.

●

WRITE FOR NEW CATALOG

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

The DOUGLAS

PRECISION SLOTTER

. . . a machine of universal usefulness — handy and productive

Available for Prompt Delivery

This modern, accurate handy machine is adaptable to both tool room and production. *Among the features which make it universally useful are:*

- vertical design
- swivelling ram-head and tool holder
- automatic circular table with independent automatic feeds in all directions
- accurate operation of ram brake
- easily adjustable stroke
- convenient arrangement of controls
- easy mounting of work without need of fixtures

DETAILS AND SPECIFICATIONS

Sizes. 7", 8", and 10" stroke

Column and base—a high tensile casting with heavy ribs for maximum stability.

Ram—with exceptionally long guide having full length adjustable taper gib for maintained accuracy; stroke length easily adjusted; may be started or stopped at any point of stroke independently of motor.

Swivelling Ram Head—Swivels 15° either side of vertical and provided with strong locking mechanism.

Toolholder and Copper Box—permits tool to clear work on return stroke as well as swivelling 90° left or right.

Rotary Table and Cross Slide—provided with conveniently located T-slots; rigid construction throughout; all slides taper gibbed; table graduated in degrees and can be clamped to saddle.

Feeds—both hand and power feeds to rotary, longitudinal and transverse table motions are provided.

Gear Box—all gears of tough steel lubricated by constant oil flow; speeds obtained by conveniently located control lever.

Send for 10-page Illustrated Bulletin Giving Complete Details.

DOUGLAS MACHINERY COMPANY, INC.

150 Broadway, New York, N.Y., Dept. 805

ANNOUNCING

The NEW #42 MURCHEY THREAD MILLING MACHINE

. . . for mass production of accurate, concentric external and internal threads from 4" to 12" diameter

This new machine meets the ever increasing demand for larger threads of extremely close tolerance produced uniformly with absolute concentricity.

PERFECT CONCENTRICITY

Internal or external surface being threaded remains concentric with the O.D. or I.D. because work does not revolve or move in any way. On this machine, the milling hob revolves eccentrically about the work and simultaneously rotates on its own axis until the cutting teeth of the milling hob are advanced into the work sufficiently to produce the required depth of thread.

When full depth has been attained and the milling operation completed, the cutter spindle automatically returns to center permitting facing and counterboring operations with guaranteed concentric relation of thread.

Outstanding Features Contributing to Fast, Precision Work and Long Life

. . . hardened and ground lead screw mounted direct on eccentric spindle bushing.

. . . rugged heavy construction throughout with sliding table mounted on amply large ways.

. . . fixture table provided with two "T" grooves and one keyway which is used only for locking purposes. "T" grooves used only to bolt fixture to table.

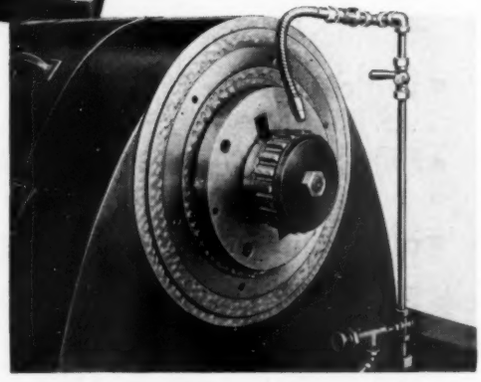
. . . all controls conveniently located near head.

. . . large spindle hardened and ground and mounted in Timken preloaded roller bearings.

. . . outer eccentric spindle sleeve runs in adjustable special phosphor bronze taper bearings.

. . . complete hydraulic unit actuates cutter feed and cutting cycle.

. . . machine may be stopped at any point in its automatic working cycle.



CONDENSED SPECIFICATIONS

Capacity: 4" to 12" dia. external or internal threads

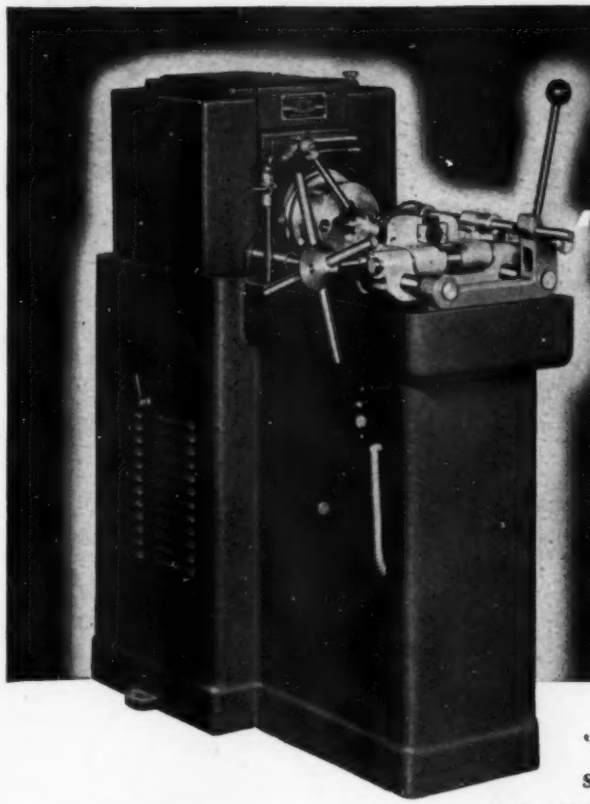
Eccentric motion of spindle: 0" to ¾"

Speeds of Cutter Spindle: 33 to 645 R.P.M.

Floor space: 37½" x 100"; height 57".

Table size: 21" x 30".

Murchey MACHINE & TOOL CO. . . . . DETROIT, MICHIGAN



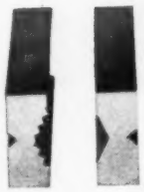
OSTER "RAPIDUCTION JUNIOR"

. . . for Fast, Accurate Threading of Bolts, Rods, Studs, Pipe, and Nipples

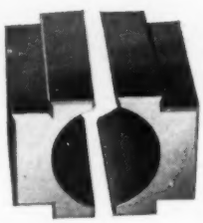
"RAPIDUCTION JUNIOR" is a low cost, high speed, threading machine. It has wide application on standard and special threading jobs. Its revolving, self-closing die-head and open-type vise facilitate the handling of stock in and out of the machine.

Here's a sample of its *per hour* performance: 500—3/8" bolts or studs of screw stock threaded one inch on one end every hour.

Illustrated at left and below are the various types of vise inserts which can be supplied with the "RAPIDUCTION JUNIOR". The machine is made in two sizes: No. 541 with a bolt range of 3/16" to 1-1/4" N. C. or Whitworth; 3/16" to 1-1/2" N.F. or B.S.F.; and No. 542 with bolt range of 3/16" to 1-1/2" N. C. or Whitworth; 3/16" to 1-3/4" N. F. or B. S. F. Both models have a regular pipe and nipple range of 1/8" to 1-1/4". Full details on request. Use form below.

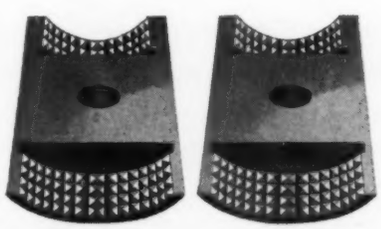


Standard vise jaws which are reversible for holding either round or square stock or hex head bolts.

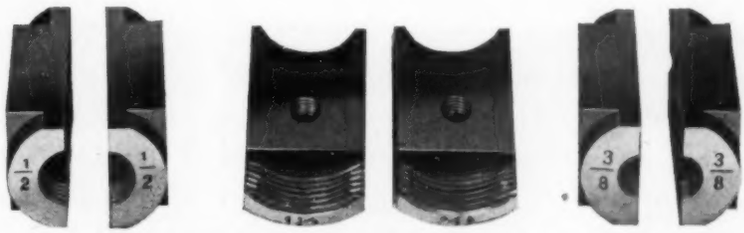


Smooth inserts for holding stock which must not be marred. {One set necessary for each size—extra equipment.}

Illustrated below are threaded inserts for holding threaded end of short nipples; each set holds two sizes {1/4" & 3/8"} {1/2" & 3/4"} {1" & 1-1/4"}—extra equipment.



Diamond point inserts for gripping plain ends of short nipples; each set holds two sizes {1/4" & 3/8"} {1/2" & 3/4"} {1" & 1-1/4"} —extra equipment.



THE OSTER MANUFACTURING COMPANY
2049 EAST 61st STREET • • • CLEVELAND, OHIO, U. S. A.

( ) Send complete description of "RAPIDUCTION JUNIOR" Threading Machines.

( ) Give name and address of your distributor in my area.

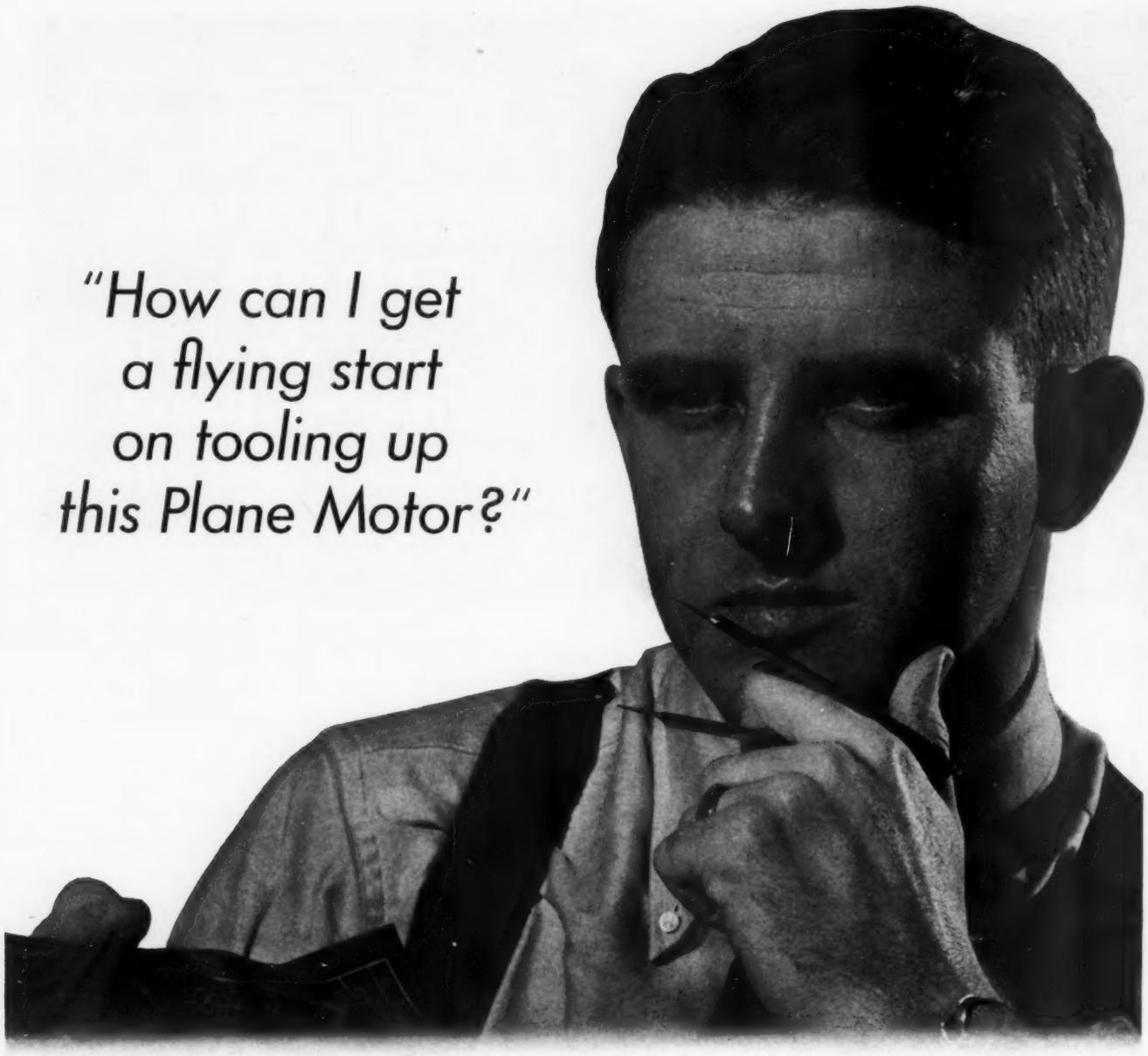
NAME .....

ADDRESS .....

CITY ..... STATE .....

Mail This—

"How can I get a flying start on tooling up this Plane Motor?"



Once his plans were set, this airplane-motor manufacturer had to get into production with a rush. But his tool-design problem was a stumbling block, and his appeals for help went begging — until he wired Taft-Peirce. Here he got instant action, and within three days Taft-Peirce engineers were at work in his plant laying out all the necessary tools, dies, jigs, and fixtures.

During the last thirty-five years the Taft-Peirce Contract Manufacturing Division has helped many a manufacturer, both in and out of the aviation industry, to win his wings with a new design. Today, Taft-Peirce manufactures experimental models, production tools, precision parts (singly or in quantity) and servicing equipment for the Air Forces of the United Nations. This service, with the exceptional breadth of experience behind it, is an ever-weightier weapon in the hands of those who fight for freedom. The Taft-Peirce Manufacturing Company, Woonsocket, Rhode Island.

Take it to Taft-Peirce

FOR DESIGN, DEVELOPMENT, TOOLING, CONTRACT MANUFACTURING

1103

TURCHAN FOLLOWER MACHINE controlling table movement of Cincinnati Machine milling part of trigger box. Almost 150 previous operations already performed are protected against possible slip in hand feeding.

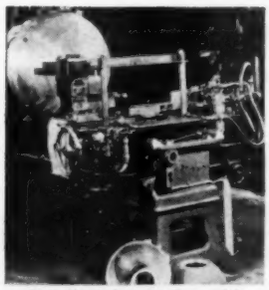
Handle surface contouring . . . on your present machines, by equipping them with

TURCHAN FOLLOWERS

ADAPTS ANY STANDARD TYPE MILLING MACHINE, BORING MILL, PLANER OR LATHE FOR FAST, ACCURATE DUPLICATING

This hydraulic surface contouring attachment—applicable to standard machines—makes it possible for *any* good machinist to perform die-sinking operations and other irregular surface machine work on existing machines. Costly special machinery and the necessity for highly trained men are avoided by the use of the TURCHAN FOLLOWER MACHINE as well as delays incident to the procurement of new equipment.

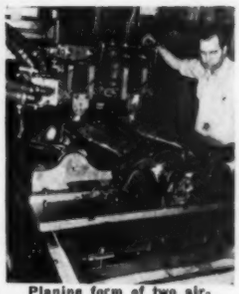
The TURCHAN unit vastly speeds up duplicating work of all kinds. It is playing an important part in many shops today busily engaged in producing war work.



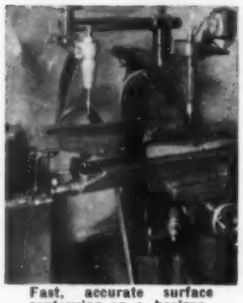
Two-dimension turning with aid of TURCHAN control

An outstanding advantage of the TURCHAN FOLLOWER MACHINE is that the operation of the machine upon which it is applied is entirely optional with each job. Change over from TURCHAN control to the standard machine requires only the simplest disengagement.

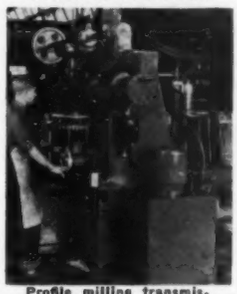
Our engineers are prepared to render prompt assistance in the solution of your surface contouring problems.



Planing form of two airplane propellers at one set-up with the aid of TURCHAN FOLLOWER.

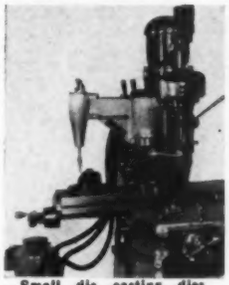


Fast, accurate surface contouring on a horizontal mill.

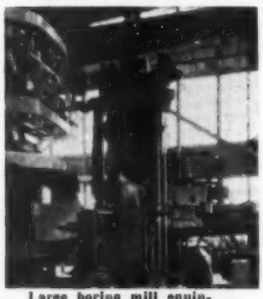


Profile milling transmission case with standard planer-type mill and TURCHAN control

Profile milling carburator castings with aid of TURCHAN follower and fixture.



Small die casting dies are easily produced by a high speed head equipped with TURCHAN control



Large boring mill equipped with TURCHAN FOLLOWER speeds reproduction of dies.

Investigate today! Give us the make and model of the machine you are considering modernizing and we'll sub it full details.

TURCHAN FOLLOWER MACHINE CO.

8259 Livernois Ave., Detroit, Michigan

National Cleveland

THE TOOLS OF TODAY AND TOMORROW

11" DIAMETER
18" LONG
END CUTTING
TAPER REAMER

NATIONAL Cleveland Tools are the tools of war for without cutting tools the arming of America would be virtually impossible. The names of vital war industry plants which crowd our ledgers today are mute testimony to the urgent need of our products and we are doing our utmost to fill that need.

But National Cleveland Tools are also the tools of tomorrow—Since 1907 we have supplied the industries of peace with cutting tools which produce the things that have made America a better place to live and after Victory has come National Cleveland Tools will again do their part in the building of an even greater America.

NATIONAL Tools CLEVELAND

THE NATIONAL TOOL COMPANY

11200 Madison Avenue, Cleveland, Ohio

HOBS • GEAR SHAPER CUTTERS • GEAR CUTTERS • MILLING CUTTERS
CIRCULAR AND FLAT FORM TOOLS • REAMERS • BROACHES
COUNTERBORES • SLITTING SAWS • SPECIAL TOOLS

IS *Your* JOB ON THIS LIST?

THREADING

- ☐ Any Size Shell
- ☐ Spark Plug
- ☐ Body Trunnion
- ☐ Cylinder Head
- ☐ Machine Gun Waterjacket
- ☐ Machine Gun Barrel
- ☐ Breech Ring
- ☐ Propeller Shaft
- ☐ Breech Block
- ☐ Fixed Ring
- ☐ Gun Cradle
- ☐ Gun Body
- ☐ Gun Barrel
- ☐ Cannon Tube
- ☐ Tank Rotor

FORMING

- ☐ Oil Groove in Connecting Rod
- ☐ Shrink Diameter of Cylinder Head

Then PLAN-O-MILL is Your Machine!

● Utilizing the revolutionary principle of planetary milling, Plan-O-Mill threads and forms with exceptional speed, accuracy, and finish.

All motion is in the milling head. The part remains stationary. Large, cumbersome pieces and small items are handled with equal ease. No special skill is necessary.

Write today for explanatory folder, "Just Push the Button". For quick action wire or telephone for earliest delivery date.

EXTRA!
PLAN-O-MILL No. 3 NOW THY-MO-TROL EQUIPPED!

Thy-Mo-Trol, developed by General Electric Engineers, converts a-c into controlled d-c. Gives infinite range of feeds for maximum production, finish, and cutter life. Reduces time of return on the biggest job to 15 seconds or less!

The **GORDON-R CO.**

MANUFACTURERS OF PLAN-O-MILL ROYAL OAK MICHIGAN

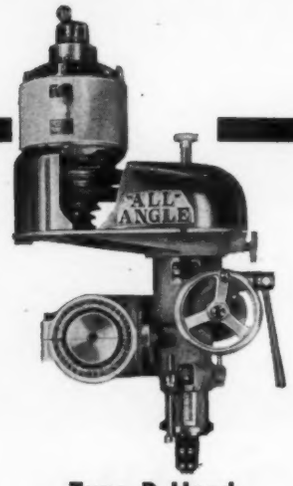
All the Flexibility of a Rubber Hose

FRAY

"All-Angle" Milling Machines and Attachments

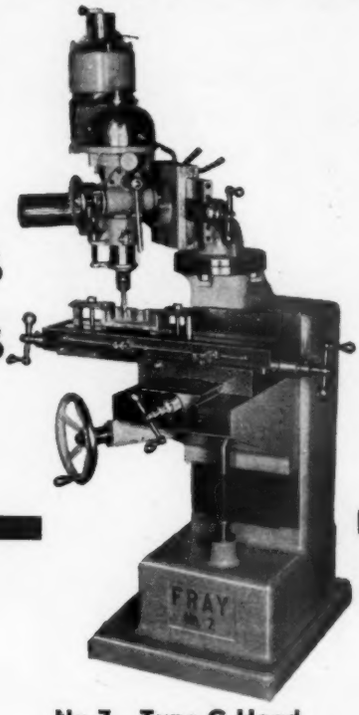
No 7-B Ram Type

Cross movement of Head above work — as well as longitudinal movement — gives complete range of operations with *one set-up.*



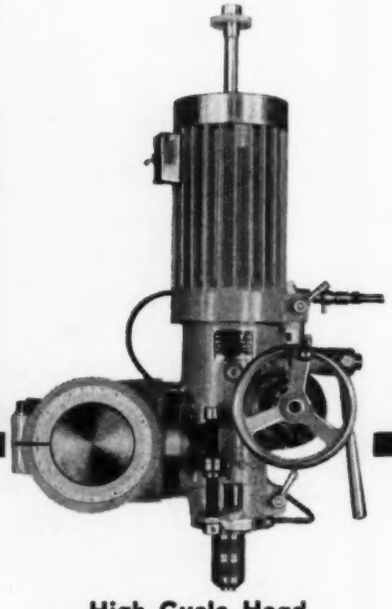
Type D Head

Motor swings completely around housing and can be locked at any point. Micrometer wheel feed or hand feed. Positive quill lock.



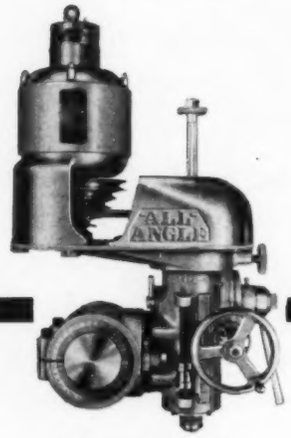
No 7—Type C Head

Full universal, quill type machine. . . . Hand wheel feed calibrated in 1/1000". Hand lever feed, micrometer depth stop, clear vision graduations on quill.



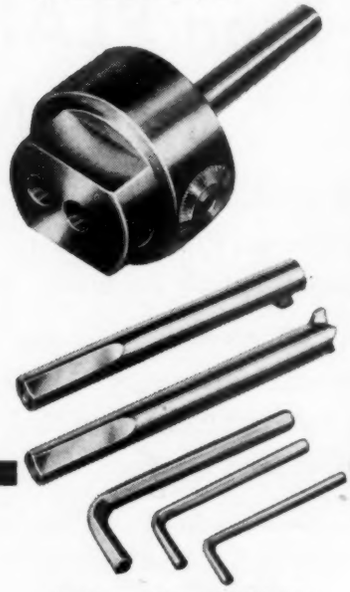
High Cycle Head

For high speed production on Dural and Aluminum Alloys . . . cutter speeds as high as 10,000 lineal feet per minute. Adapted to Types A. B and C Heads.



Type C Head

Complete with FRAY Heavy Duty ½ H.P. 3-phase, 220 V, 50/60 cycle motor, 1 collet for ½" straight shank end mills. Spindle No. 7 Brown & Sharp, Alemite grease gun and wrench.



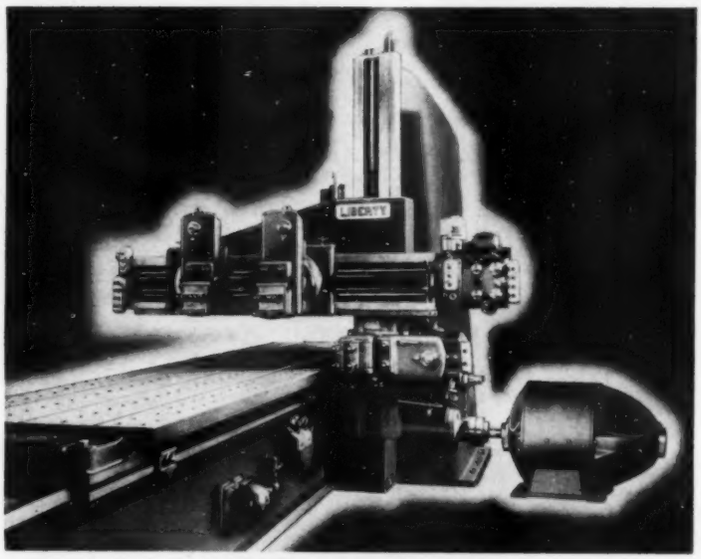
Micrometer OFFSET Boring Heads

Standard—body diameter 3", offsets 1¼". Micrometer, 50 divisions of .001". Also available in Junior Model, 2" body diameter — Complete with boring bars and wrenches.

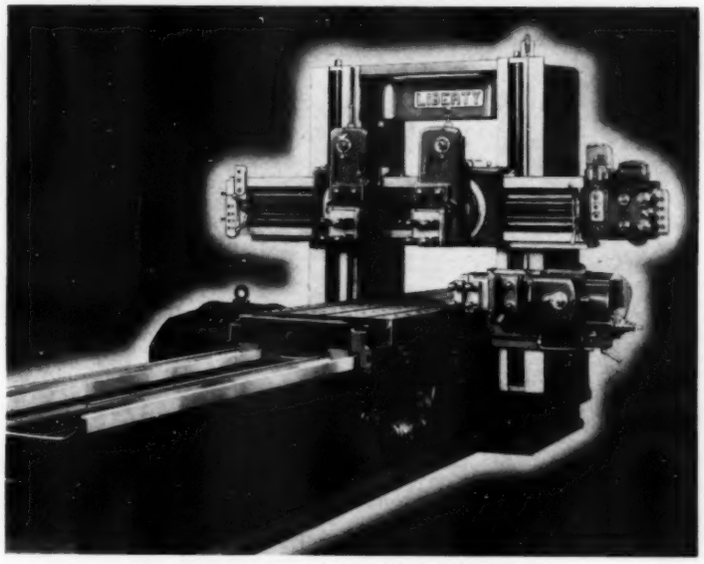
FRAY MACHINE TOOL COMPANY

517 W. Windsor Road Glendale, Calif.

LIBERTY PLANERS



LIBERTY OPEN SIDE PLANERS.



LIBERTY DOUBLE HOUSING PLANERS.

Served in World War I

•

A PRIME FACTOR TO EXCLUSIVE WAR PRODUCTION

in World War II

•

With more and more plants changing over from conventional lines to an all out War schedule the need for speedy — accurate — sturdy Planers is being supplied in many plants with Liberty Planers.

Engineered for longer life and sustained accuracy the new design Liberty Planers feature rail heads offset toward center and side heads offset toward top. All heads and tool slides have rapid traverse and power feed in all directions. Dual push button control, automatic clamping of cross rail and friction type electric feeds are provided.

Other construction features include: forced feed lubrication to vees and bearings, all gears run in oil bath, hold down gibs run full length of table, and forged steel racks are dowelled and bolted to table.

Bulletins 152 and 153 give full details

LIBERTY PLANERS, INC.
HAMILTON, OHIO

Prompt Delivery!—We can offer exceptionally good deliveries on several sizes of Liberty Double Housing Planers. Your orders accompanied with recognized priorities will enable you to secure early datings. Write, stating size Planer in which you are interested from 24" to 72"—Openside and Double Housing types. We will gladly quote.

LIBERTY PLANERS, INC.
HAMILTON, OHIO

CATALOGS 152 and 153

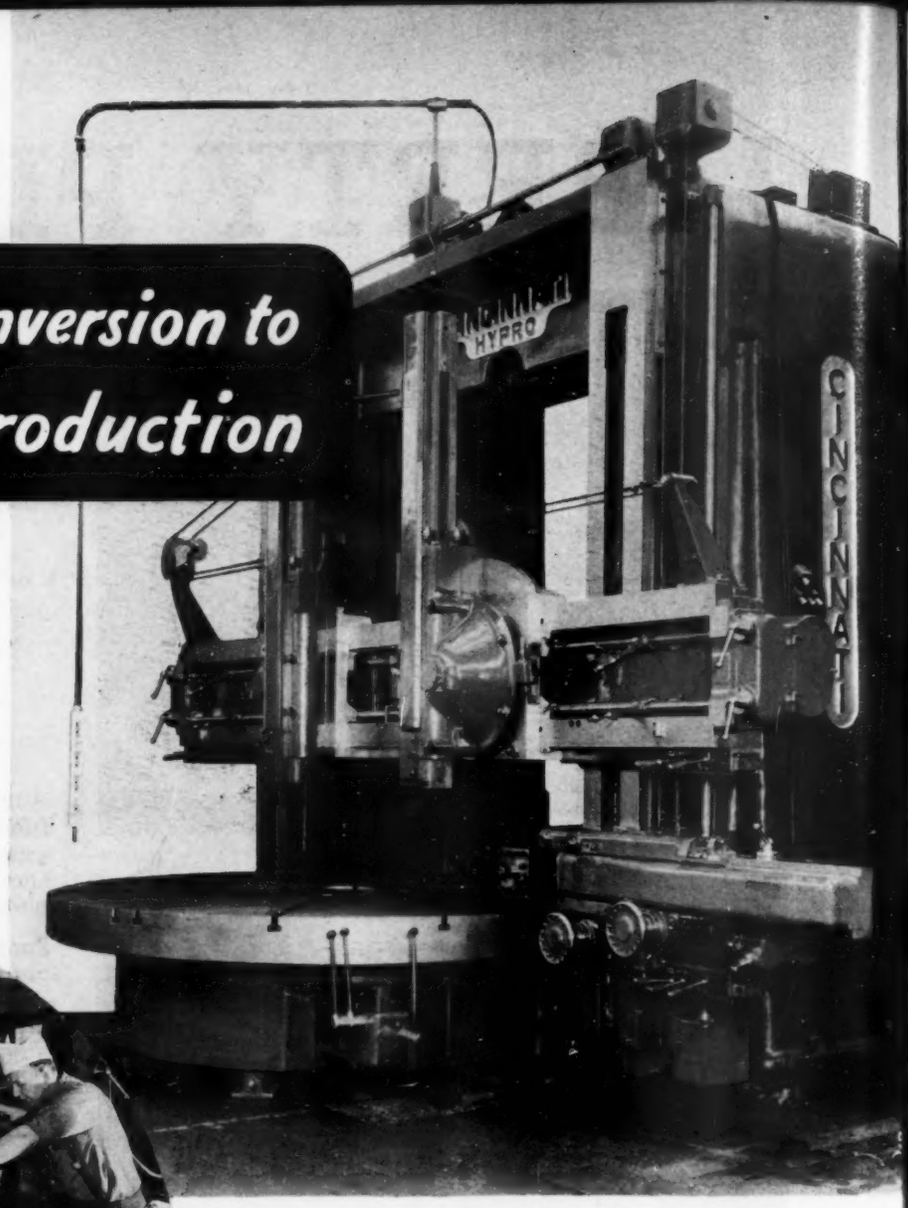
Please send us your catalogs Nos. 152 and 153.
Have your representative call

NAME .....

TITLE .....

ADDRESS .....

Important for conversion to exclusive War Production



CINCINNATI Hypro VERTICAL BORING MILL

A typical Conversion Job

Above is a Cincinnati Hypro Vertical Boring Mill in the tank plant of a concern formerly producing automobiles. This machine is turning the lower rim of a cast armor steel turret at cutting speeds up to 150 ft. per minute. The operations include rough and finish turning and facing several diameters to particularly close tolerances.

• With industry gearing itself for "all out" War production many plants have been called upon to handle tank and heavy arms production. Cincinnati Hypro Vertical Boring Mills are now engaged in this type of work and have both power and stamina for 24 hour operation plus capacity for high production. Centralization of controls makes for ease of operation and increased output. Put your war turning jobs on a Cincinnati Hypro for speed, accuracy and versatility.

THE CINCINNATI PLANER CO.

Cincinnati, Ohio

HYDRAULIC ARBOR PRESSES

—are as FAST as ...

SPIN THE HANDWHEEL and the ram speeds to the work by fast mechanical action instead of slow, laborious hydraulic pumping.

FLIP THE BALL ARM to close the valve instead of slowly turning a handwheel type control.

START PUMPING and immediately get tons of pressure on the work because the hydraulic cylinder was automatically filled with oil during oper. No. 1.

● With Time so terribly short, every second saved in any operation adds greatly to our War effort. The built-in Speed of KRW Presses is as Fast, and simple, as A B C. KRW Hydraulic Arbor Presses are fast bringing the ram to the work... fast in developing hydraulic pressure... fast in raising the ram to remove the work. Another time and labor saving KRW feature is the stationary bed adjustment control... no matter where you move the bed, the ratchet control crank remains at convenient operating height. Write for bulletin describing 25, 50 and 75 ton presses... priced from $198.00*.

**Prices F. O. B. Arcade, N. Y. Slightly higher west of Rockies*

K. R. WILSON

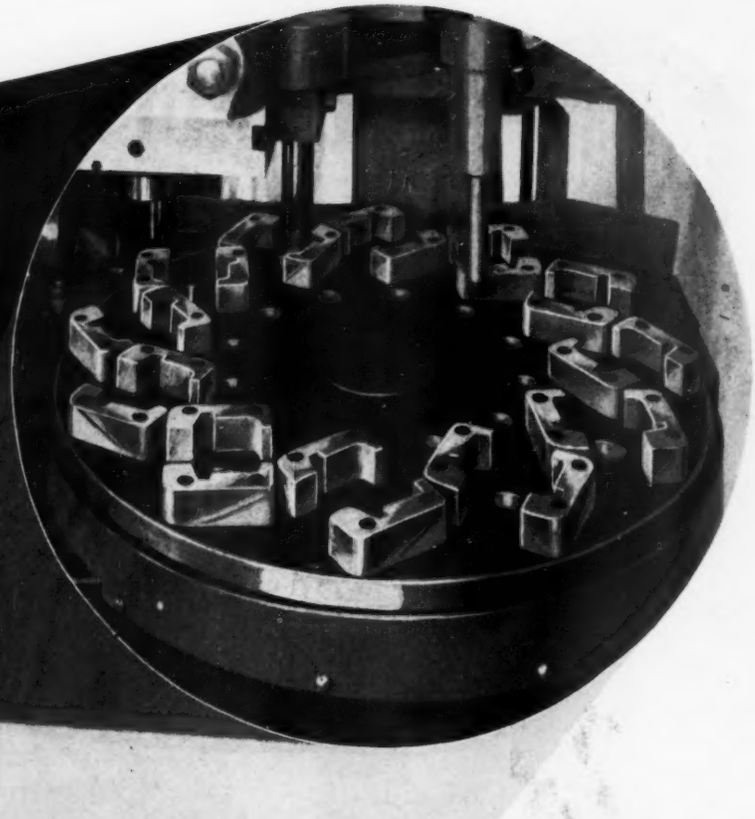
MAIN OFFICE: LOCK ST., BUFFALO, N. Y., U. S. A.
EXPORT OFFICE: 90 WEST ST., NEW YORK, N.Y., U. S. A.
WEST COAST: Osborne Mach. Co., San Francisco, Calif., U. S. A.
Smith-Booth-Usher Co., Los Angeles, Calif., U. S. A.

MAIL THIS COUPON

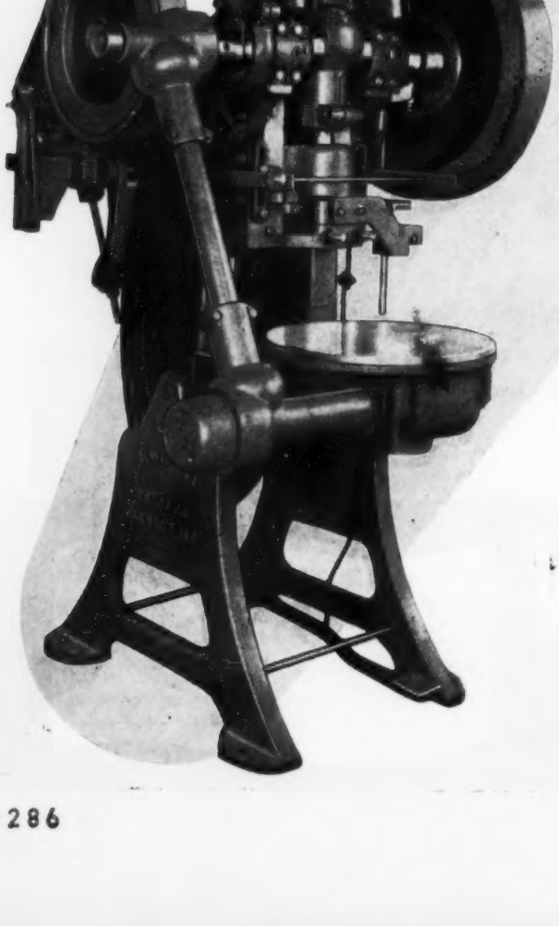
K. R. WILSON, 38 Lock St., Buffalo, N. Y.
Please send Hydraulic Arbor Press Bulletin No. 38.

Name .....
Address .....
City .....State .....

3 TO 6 TIMES FASTER



FEDERAL DIAL FEED PRESSES



HUNDREDS of companies are speeding up a variety of primary and secondary operations three to six times, and even more, by the use of these new Federal precision-built presses with multiple dial feeds. In the exclusive Federal dial, all moving parts are enclosed. Positive indexing and locking mechanism smooths out the dial action, permitting unusually high speeds with exceptional accuracy and safety to the operator. Cannot skip or coast by stations. Can be indexed in any part of 120° crankshaft revolution — giving long or short dwell of dial. Automatic loading and ejector mechanisms can be furnished if desired. Dial feeds are available on eight sizes of Federal Presses.

★ VITAL TO DEFENSE PRODUCTION ★

Speed and more speed in production is the need of the hour. Federal Presses are helping many companies to produce vital war materials rapidly in a variety of ways. Perhaps they can help you, too. Write us — no obligation.

THE FEDERAL PRESS CO.
Elkhart, Indiana

MANY FEDERAL MODELS

Federal Open-Back, Inclinable Presses are available in nine sizes with capacities ranging from six to 80 tons—either fly-wheel or geared type. They represent the culmination of 40 years' intensive experience in press building.

SAVE TIME *and* MONE
with Single-Leg Gantry Crane

Upper photo courtesy of The Warner & Swasey Co., Cleveland, Ohio.
Lower photo courtesy of The John Bertram & Sons Co., Ltd. Dundas, Ont., Canada.

Recently it was planned to equip a large plant with over 100 swinging jib cranes, each of which would give coverage to a small circular area. This scheme would not permit transportation between areas. A study revealed that 25 single-leg gantry cranes would give far better coverage at a considerable price advantage.

Similarly in other plants, gantry cranes have eliminated the need of purchasing one or more large overhead cranes. As a result, appreciable savings have been made in original cost, because several gantry cranes can usually be bought for the price of one heavy overhead crane. And of significant importance, better handling service is provided.

Why not check into the possibilities offered by inexpensive Cleveland Tramrail single-leg gantry cranes today? They are built for hand or electric operation in capacities up to five tons.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1127 EAST 283RD ST. WICKLIFFE, OHIO.

GET THIS BOOK!

BOOKLET No. 2008 . . Packed with valuable information. Profusely illustrated. Write

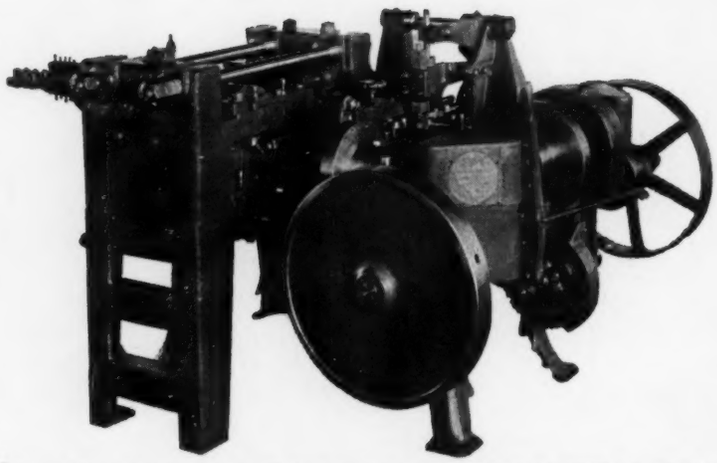
MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSE

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT

HANDLE YOUR SWAGING, STAMPING, PIERCING, BLANKING and FORMING of COILED METAL

ON THE NEW NILSON AUTOMATIC PRESS and FOUR SLIDE MACHINES



These Nilson machines are built in two sizes and are fully described in Bulletin No. 90, available promptly on request.

. . . for fast, heavy duty work

An outstanding feature of these combination power press and four slide machines is the powerful, silent action of the main press slide which is operated by crank motion through toggle or knuckle joints. Overhead stay rods contribute to the tremendous strength and rigidity of this machine.

Other features include simple and easy changing of accessible and removable die set, open construction of forming slides and tool adjustments made without interference.

•

Nilson's more than 30-year experience in the design, development and manufacture of special, high production automatic machinery is available to assist you in producing any special machines you may require. Consult our engineers and be assured of a comprehensive service.

•

THE A. H. NILSON MACHINE CO. . . . *Bridgeport, Conn.*

MULTIPLYING MAN POWER

With "Buffalo" Universal Iron Workers on the job the production of every man-hour reaches new peaks. These versatile machines are brutes for punishment, easy to operate, built to handle the toughest assignments on continuous day-and-night schedules. Here's modern speed in metal working—and with marked savings in every unit produced!

for
PUNCHING . . SHEARING
SLITTING . . COPING . . NOTCHING
of
ANGLES . . TEES . . CHANNELS
I-BEAMS . . ROUNDS . . SQUARES
FLATS . . PLATES

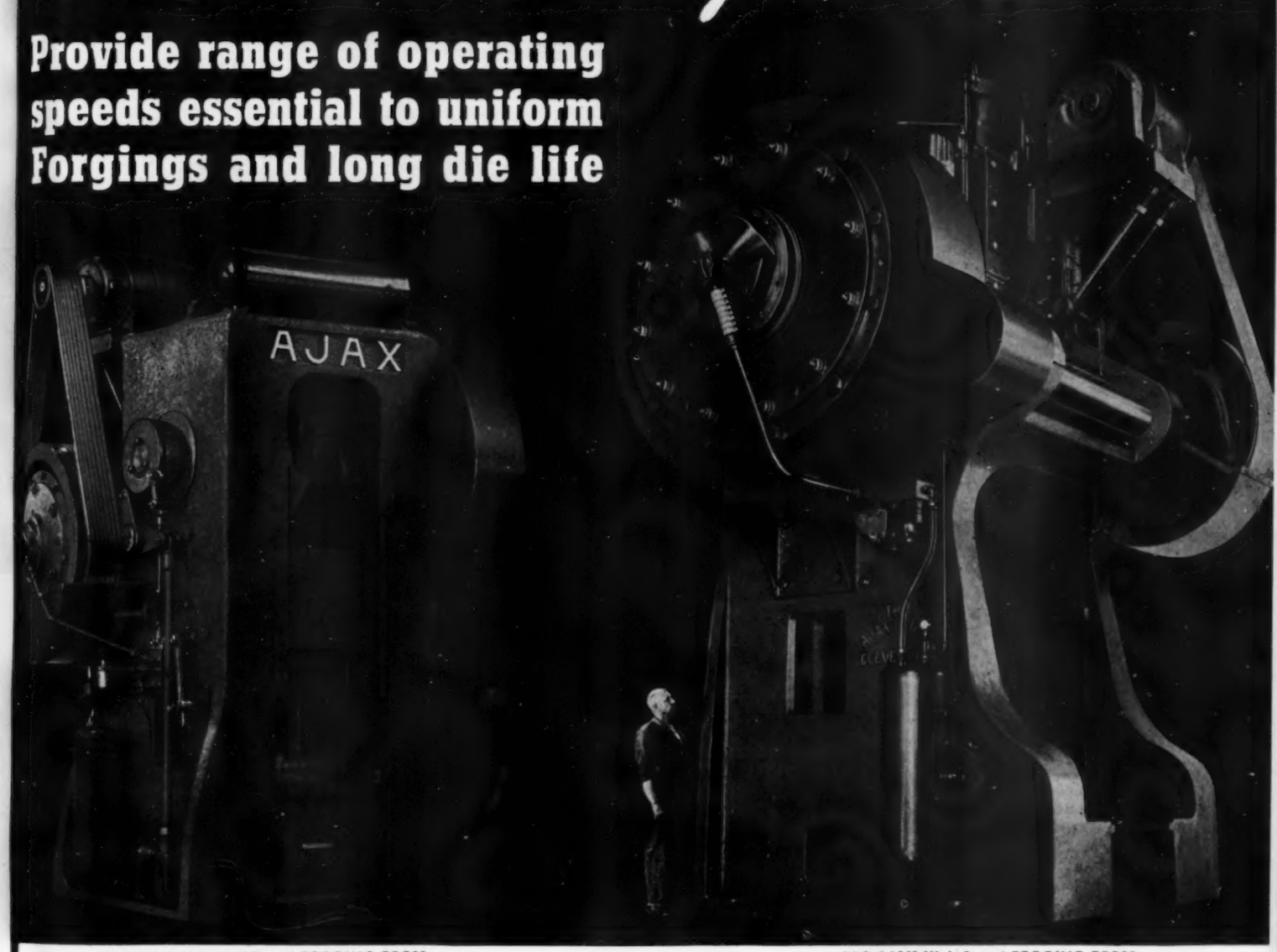
BUFFALO FORGE COMPANY

448 Broadway, Buffalo, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" **UNIVERSAL IRON WORKERS**

AJAX FORGING PRESSES with *Direct-Acting Air Clutch*

Provide range of operating speeds essential to uniform Forgings and long die life



13C-AJAX Standard Speed FORGING PRESS

20C-AJAX High Speed FORGING PRESS

UNQUESTIONABLY, proper speed of operation is a most essential factor in producing press forgings that are uniform in size and metallurgical properties, and for realizing maximum die life for forging being produced. When operating speeds are too low, excessive transfer of heat from the stock to the dies causes excessive die wear, while chilling of the stock interferes with its flow and the proper filling of the die impressions. Since the constant ram travel brings the dies fully closed at each stroke, if operating speeds are too high, excessively rapid metal flow across the die surfaces, particularly on extrusion forging, produces abrasion on die surfaces that materially shortens die life. These and other obstacles to the production of accurate uniform forgings and satisfactory die life are eliminated by AJAX Standard and High Speed Forging Presses with Direct-Acting Air Clutch which covers the whole range of desirable operating speeds.

From the standpoint of speedier production, the smooth cushioned starting at speeds far exceeding past limits makes possible completion of several operations such as fullering, roughing and finishing, without reheating. Furthermore the instantaneous response of the AJAX Air Clutch to effortless tripping automatically adjusts the operating cycle of the Press to the natural working rhythm of the operator, giving increased outputs with less exertion.

Uniformity of product, close tolerances, longer die life and the increased production made possible by the AJAX Direct-Acting Air Clutch are further evidence of the long range wisdom of buying forging equipment on the basis of mechanical soundness. Write for Bulletin 75.

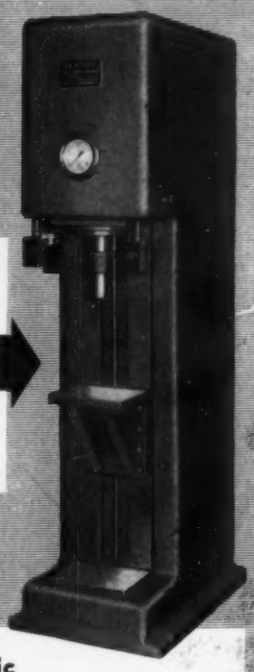
★ *BUY FORGING EQUIPMENT ON THE BASIS OF MECHANICAL SOUNDNESS* ★

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND, OHIO

621 MARQUETTE BUILDING • CHICAGO, ILLINOIS

QUICK CHANGES
HERE
SPEED SMALL-
LOT PRESSING



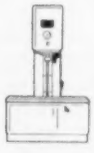
DLKC2 HydrOILic KNEE-TYPE PRESS OFFERS RAPID TOOL-CHANGING - - - HANDLES WIDE RANGE OF PRESSING OPERATIONS

The ease with which you can retool this DLKC2 HydrOILic press for one job after another is just the *first* thing you'll like about it. Its smooth, flexible *oil hydraulic* power, speed and control give you a new "whip" on production efficiency. The modern cut of its space-saving, projection-free, rounded frame clears the way for fast, accurate, safe operation. And the DLKC2 takes to production-line pressing jobs equally well. This versatile press is built in 5 and 15 ton capacities, with manual or electric control (or both). Maximum stroke is 18 inches; maximum daylight opening, 46 inches. Write for full details.

DLO52-50

DLO52-100

DLSC2

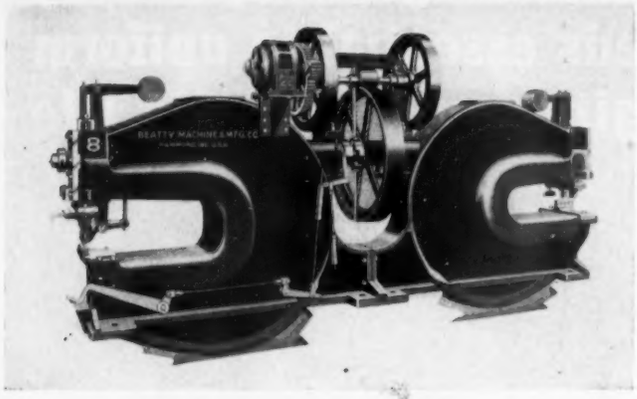


DLAC2

Write today for complete new DATA BOOK on 5-to-100-ton HydrOILic Presses. The Denison Engineering Company, 1164 Dublin Road, Columbus, Ohio.

WHEREVER YOU NEED
POWER-SPEED-CONTROL
Check ✓
DENISON EQUIPMENT for APPLIED
HydrOILics

"SIAMESE TWINS" Doing *Double* Duty



This BEATTY Double End Punch conserves floor space, reduces man power required for operation. Machines are timed to punch alternately. Machine is available with plain table or architectural type table at either or both ends . . . interchangeable tools provide punching or shearing on either or both ends. Available in a full range of throat depths. Widely used in the shipbuilding, tank, railroad, and aircraft industries. This model is one of a complete line of Detail Punches, Single End Punches and Shears, Beam Punches, Flush Front Shears, Horizontal Punches and Heavy Duty Plate Shears. If you have a heavy metal fabrication problem, call in a Beatty engineer.

BEFORE YOU BUY SEE BEATTY FIRST

Illustrating, left to right: 1. Beatty Hydraulic Brake and Flanging Machine. 2. Self-Contained Hydraulic Press. 3. Extruding Press. All are available in a complete range of sizes. Write for bulletins.

BEATTY MACHINE & MFG. COMPANY
HAMMOND, INDIANA

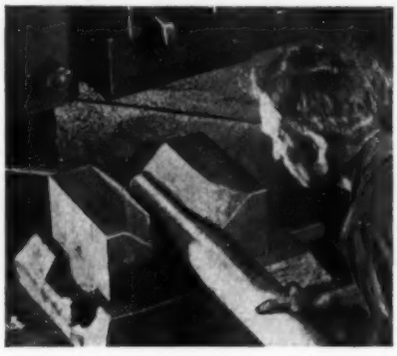
FORGE IT FASTER

with the *only* air-actuated hammer performance tested by over 1100 users in more than 70 different industries!

A complete description of all NAZEL hammers . . . Stories of savings that paid for hammers in one year . . . This and much other data is in the NAZEL HAMMER BOOK.

FREE upon request on your letterhead.

★ These NAZEL users include many of the most famous names in industry— and our report of NAZEL performance is their report to us.



Thus, when we say the power and speed of this self-contained hammer shapes metal quicker and more accurately, we're quoting forge-shop experience. There's proof aplenty of how its

POWERFUL, SQUEEZING BLOW PRODUCES GOOD FORGINGS WITH FEWER REHEATS

Likewise, the way we know smiths find it easy and natural to operate this hammer, is that they have told us so.

They can control the force of the blow with the greatest precision . . . strike light, medium or heavy blows, at will, *without change in speed*. Just with a touch of the foot on the treadle, or, in two-man operation, by use of the side control lever.

And, since NAZEL strikes always the same number of blows per minute, there's an unbroken rhythm of operation that speeds through more work per man hour!

WINGS-TO-CONVERSION, AUTO PLANTS FIND

Because air-actuated hammers operate wherever current is available, independent of piping or auxiliary equipment, NAZELS are readily adapted to changing production lines. And, they'll shift back as readily when peacetime needs again call for their re-location.

They're usable anytime, anywhere. And—remember—they consume power *only* when operating.

LOBDELL COMPANY
WILMINGTON, DELAWARE

• Made in 12 sizes—4 types—for every kind of forging.

LOBDELL-NAZEL

THE SELF-CONTAINED FORGING HAMMER

"EVEN TODAY . . . DELIVERIES ARE PROMPT!"

MILFORD PROFILE SAW

. . . for all contour-sawing, jig and band saw machines

More Profile Saw is being made and shipped than we thought possible a year ago. Our greatly increased capacity is taking care of the demand, and you don't have to wait long for deliveries.

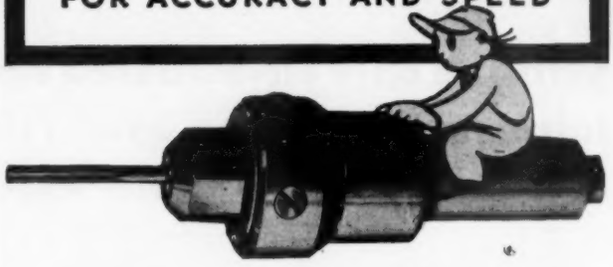
Remember . . . when you use Milford Profile Saw you've got the best there is. It's the perfected product of specialists, with over a half century's experience behind them. Specialists who originated, and are the world's largest producer of, Profile Saw!

Order from your Mill Supply Distributor

★ Are you taking full advantage of the savings in time, money and basic equipment possible with Profile Saw? If you have a band saw machine it can be easily adapted to profile sawing. Write us at once for directions and a free sample of MILFORD PROFILE SAW, giving description of cutting job and machine.

THE HENRY G. THOMPSON & SON COMPANY
NEW HAVEN, CONNECTICUT
Also makers of MILFORD REZISTOR HACKSAW BLADES

UNIVERSAL COLLET CHUCKS FOR ACCURACY AND SPEED



Universal *floating* collet chucks (above) are designed to operate horizontally in automatic screw machines and turret lathes. Adjustable spring pressure in 4 directions prevents dogtail motion and marred holes.

Universal *standard* collet chucks have ground threads, ample room for tool feed out and are ideal for holding end mills, keyway cutters, drills, etc. Nut fluted for Spanner wrench. Universal collet chucks grip as strong as solid steel itself. Write today for facts and prices.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

HEAT-FAG and ACCIDENTS *Ride Together*

Beware of HEAT-FAG!

IT STRIKES at workers when sweating reduces the normal salt balance in their bodies. It increases fatigue — paves the way for carelessness — costly mistakes, accidents.

MORTON'S *Salt Tablets*

Install Morton's Dispensers by all drinking fountains, so workers can take tablets to replace the salt lost by sweating.

ORDER NOW!

Salt Tablets Case of 9000 **$2.60**

Salt-Dextrose Tablets Case of 9000 **$3.15**

Dispensers

500-tablet size **$3.25**

1000-tablet size **$4.00**

MORTON SALT CO., Chicago, Ill.

"AMERICAN SWISS"

could bring Vulcan up-to-date

MYTHICAL Vulcan, the Roman god of forging, would learn a few things from a visit to the "American Swiss" plant.

He would learn how file blanks are swiftly forged with an accuracy that even a Roman god would find it hard to equal. And if he followed through the further operations on these file blanks, he would learn how closely uniform and astonishingly accurate are the annealing, stripping, cutting, etching and hardening operations in the manufacture of these Swiss-Pattern files of precision.

3000 different shapes and sizes

●

A type for every intricate or precision filing job

"American Swiss" file users know how this care and skill are reflected in the faster, better work and long life of these files. That's why "American Swiss" Swiss-Pattern Files are in demand by tool makers, die makers and machinists engaged in war industry work all over the country.

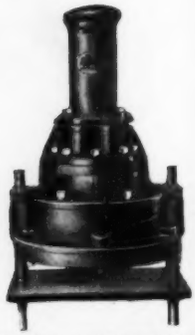
AMERICAN SWISS FILE & TOOL CO. • ELIZABETH, NEW JERSEY

American Swiss
SWISS-PATTERN FILES

Buhr

. . . CAN HELP YOU CONVERT YOUR MACHINES
TO FAST WAR PRODUCTION WITH VERSATILE BUHR . . .

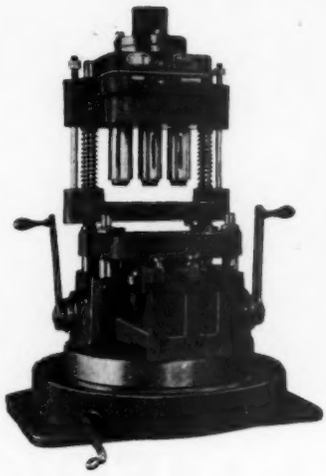
DRILLING and TAPPING HEADS



★ **SEND BLUEPRINTS**
of your drilling-tapping jobs. Experienced BUHR engineers will recommend exactly the right heads . . . no obligation.

Why use many machines when one will do?

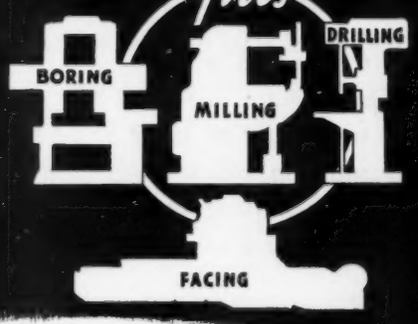
In the country's leading automotive plants, BUHR drilling and tapping heads are speeding production of armament by consolidating machine lines . . . saving floor space, time and labor. BUHR heads can be used economically either for intermittent set ups on short orders or large production jobs. Large range of adjustable, ball bearing, multiple spindle head types and sizes. Write BUHR today for new literature giving details and specifications.



BUHR MACHINE TOOL COMPANY
ANN ARBOR, MICHIGAN

This OR *This*

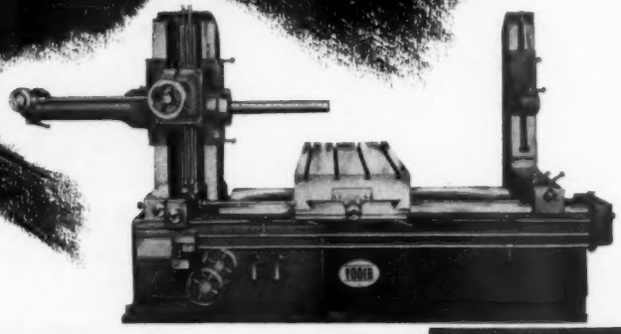
A Variety of Uses!



ENGINEERING YODER MANUFACTURING

HORIZONTAL BORING MILL

For small and large hole boring.
For end and face milling.
For slot and gear milling.
For drilling and tapping for location.
For face-finishing sides of parts.



We have a folder for you.
Write Now, RIGHT NOW!

The ENGINEERING YODER MANUFACTURING **SALES COMPANY**
5500 WALWORTH AVE.
CLEVELAND, OHIO

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

PUNCHINGS STAMPINGS ASSEMBLIES

Quick action on your problem! Use our manufacturing facilities as your branch factory. Well-equipped for small and medium-sized work. Investigate time-saving possibilities *today!* Send prints or samples.

M & M MANUFACTURING CORP.
FORTVILLE, INDIANA

STEEL RINGS

3/8" ID to 108" OD

When you need steel rings (in sizes from 1/4" to 108") call on Dresser! We've been making rings for over 60 years. Our complete facilities (rolls, expanders, hydraulic presses, modern gas furnaces, automatic welding machines, etc.) plus our experience and ability, insure quick delivery of your job exactly as ordered.

Get complete details of our service and experience today. Send prints or samples for estimate.

DRESSER MANUFACTURING COMPANY
Department RER — Bradford, Pa.

MACHINISTS AND ENGINEERS
FIDELITY MACHINE COMPANY
3908-18 Frankford Ave. — Phila., Pa.
Jefferson 7600-1-2

MACHINES AND PARTS, SPECIAL TOOLS, ETC.

to your specifications

SPECIAL ENGINEERING WORK

. . . on Contract

It will pay you to investigate our facilities. As designers and builders of wire and ribbon stock forming machines we can offer you skilled and experienced assistance. Send us your blueprints or samples for prompt quotations.

We also solicit your bids for cam milling

THE A. H. NILSON MACHINE CO. — Bridgeport, Conn.

QUALITY

SCREW MACHINE PRODUCTS

• ● •

WALTHAM SCREW COMPANY
WALTHAM • MASS.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place — New York City
36 years experience in metal fabrication.

DESIGNERS OF
• TOOLS, JIGS, FIXTURES
• SPECIAL MACHINERY
ORDNANCE WORK A SPECIALTY
OLD COLONY ENGINEERING CO.
180 WEEDEN ST. — PAWTUCKET, R. I.

WE SOLVE TOOLING PROBLEMS
Designers of
TOOLS • DIES • JIGS
FIXTURES • GAGES
Our staff is experienced in tooling up, processing and designing for war production. We can handle your problem. Your inquiry entails no obligation.
ALGER ENGINEERING CO.
2539 Woodward Ave. — Detroit, Mich.

DIE — MOLD
COATING — DRESSING
BONIS
B O N I S
ST. JOHN X-RAY SERVICE, Inc.
Long Island City, N. Y.

FOR LIGHT OR HEAVY
METAL STAMPINGS

WORCESTER PRESSED STEEL COMPANY
WORCESTER, MASSACHUSETTS

DESIGNERS OF
Jigs, Fixtures & Dies
Prompt Service
LAWRENCE W. SECREST
P. O. Box 265
Alexandria — Virginia

"Small Jobs Welcome"
BRONZE & ALUMINUM CASTINGS
NAMEPLATES
Rough or Machined
COMPLETE PATTERN SHOP
Prompt Service — Let Us Quote You
BRONZE TABLET FOUNDRY, INC.
572 Broadway — New York, N. Y.

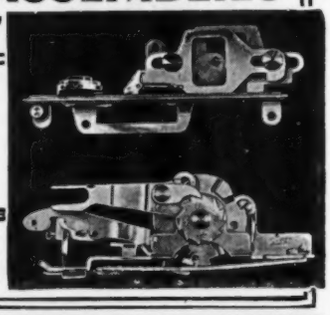
DESIGN & BUILD
JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
BOX 462
PAWTUCKET, R. I.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

STAMPINGS AND ASSEMBLIES

"GREATER SAVINGS WITH GREIST"



We can make short or long runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. We are also fully equipped to make

SCREW MACHINE PRODUCTS
TOOLS, DIES, JIGS, FIXTURES

Quality work by skilled mechanics is assured. Send your blueprints or samples today!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy

SPECIAL MACHINERY

CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL.

METAL STAMPINGS

• TOOLS • DIES •

PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER

STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.

KIRK & BLUM

WELDED MACHINE BASES, PEDESTALS and FRAMES
LATHE PANS
GEAR and BELT GUARDS
Pressed Steel Louver Panels and Cover Plates

THE KIRK & BLUM MFG. CO.
2823 Spring Grove Ave., Cincinnati, Ohio

Need steel balls

for defense assemblies ?

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.

ABBOTT BEARING BALLS

LATHE WORK WANTED

MAGNUS
47-18 37 St. Long Island City

MACHINE SHOP WANTS DEFENSE WORK

Lathes, Milling Machines, Drill Presses, Riveting, Hot Dip Tinning, Jigs and Fixtures. Investigate TODAY.

STEPHEN J. LEWIS ENGINEERING CO.
215 Butler St. Triangle 5-5348 Brooklyn, N. Y.

SPECIAL HAND FORGINGS

Small Sizes
Limited capacity available

STEEL PRODUCTS SALES CORP.
52 Vanderbilt Ave., New York, N. Y.

COMMERCIAL HEAT TREATING

Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories

AGERSTRAND CORPORATION
Muskegon, Michigan

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmanship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO., INC.
HOCKESSIN DELAWARE

INSULATED WIRE

CUT TO SIZE WITH AUTOMATIC MACHINERY

We specialize in cutting to size and stripping one or both ends of all insulated wire. Also equipped to attach ends and terminals to wires.

Quotations gladly given

KORKO MANUFACTURING CO.
339 North Third St., Phila., Pa.

WORK WANTED FOR

Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.

HAIDA ENGINEERING CO.
34-11 Vernon Blvd. Long Island City, N. Y.

MACHINE TOOL REBUILDING

Well-equipped shop with many years experience wants work.

MAGNUS MACHINE REPAIRS
47-18 37th St. Long Island City, N. Y.

PATTERNS in WOOD and METAL

For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY

Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.

GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

GEST ENGINEERING & EQUIPMENT CO.

Ordnance and Defense Plant Equipment
Industrial Engineers
Jigs, Fixtures, Gages and Special Mach.

31 East, Georgia St. Indianapolis, Ind.

WIRE AND METAL SPECIALTIES

In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY
Plating and finishing.

EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.
PROPOSALS. 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., June 15th will appear in the issue of June 25th, subject to limitations of space available.

POSITIONS VACANT
(See also "Selling Opportunities" Offered)

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

DESIGNING ENGINEER and detail draftsmen. Must have experience in either heavy machinery or structural design. P-248, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

MACHINE SHOP FOREMAN or Assistant Foreman. Long established Southern manufacturer specializing in small machine parts now engaged in war production needs all around machinist with supervisory experience. State qualifications, references and salary expected. P-261, American Machinist, 330 W. 42nd St., New York, N. Y.

MECHANICAL ENGINEER—Under 50, wanted by Philadelphia manufacturer of hydraulic auto lifts, elevators, etc. Experienced in machine shop operations, drafting and design. Permanent position looking toward post-war period, with old, established firm. Good salary to qualified man. Write in detail, giving experience, past earnings, etc. P-262, American Machinist, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc. 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

EXECUTIVE—Thirty years experience in Product Design, Production, Tooling and Factory Management. Experienced in Costs, Labor Negotiations and special Sales. American citizen. Technical Graduate. PW-249, American Machinist, 330 W. 42nd St., New York, N. Y.

SPRAYER—15 years experience as foreman with all types of spray guns. Will work anywhere in New York State. PW-251, American Machinist, 330 W. 42nd St., New York, N. Y.

INDUSTRIAL ENGINEER, employed, with comprehensive management and production experience, metal products, desires permanent position. University graduate. Married. PW-250, American Machinist, 330 W. 42nd St., New York, N. Y.

FACTORY MANAGER or Superintendent with 30 years experience in the development and the production of tools, machinery, electrical, optical and mechanical devices. Interested in connections paying $10,000 per year. PW-245, American Machinist, 330 W. 42nd St., New York, N. Y.

(POSITION WANTED)

CARBIDE TOOL ENGINEER

With proven record of over 12 years, carbide applications from shell turning to precision aircraft parts. Steel applications a specialty. Draft status excellent. U. S. Citizen. Available at once; locate anywhere. Principals only.

PW-260, American Machinist
330 West 42nd St., New York City

WANTED

MACHINE TOOL DESIGNER

One of the finest equipped plants in the Metropolitan District requires a machine tool designer of the highest type; one who has proven ability in creative work and initiative. This is a rare opportunity for the right man. No letter considered that does not give complete details of background.

P-240, American Machinist
330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives Salesmen—Additional Lines

OPPORTUNITY OFFERED

SALES ENGINEER for established Eastern territory by Machine Tool Builder located vicinity Newark. State qualifications and experience. SW-263, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

PATENT ATTORNEY, CONSULTING ENG'R, Over twenty years engineering experience with patents. Confidential, Personal Service. David Manly Heller, 134 North LaSalle, Chicago.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on the page Facing the inside back cover.

FOR SALE

Patterns and Detail Drawings of Surface Grinder

7" x 20" Mechanical Feed Excello Spindle. Sample machine has been operating successfully for two years in plant production.

BO 265 American Machinist
330 W. 42nd St., New York, N. Y.

PROFESSIONAL SERVICES

MORRIS AND VAN WORMER

Est. 1924

Production Engineers

WAR PRODUCTION

METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION

25 Broad Street New York City

"TECHNICAL ABILITY and MANPOWER"

to do your

Electrical and Mechanical Designing!

Complete Plan Preparation—Specifications
Estimates—Installation Supervision
Industrial Plant Planning
Layouts—Production Systems, etc.
Ample Facilities—Maintained Schedules

Write—Wire or Phone

Equipment Engineering Associates

Telephone—ANDover: 3420-21
64 W. Randolph St. CHICAGO, Ill.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

WANTED

BATH UNIVERSAL GRINDER

Countershaft not required. Condition of spindle unimportant. Advise price.

W-259, American Machinist
520 No. Michigan Ave., Chicago, Ill.

AUDELS

MACHINISTS

AND TOOL MAKERS HANDY BOOK

JUST OUT!

1600 PAGES FULLY ILLUSTRATED

ASK TO SEE IT

A READY REFERENCE
Tells How to Operate and Set Up Lathes, Screw and Milling Machines, Shapers, Drill Presses and All Other Machine Tools.

A KEY TO SHOP PRACTICE
In All Branches. For Every Machinist, Toolmaker, Machine Operator, Draughtsman, Metal Worker, Mechanic and Student.

5 PRACTICAL BOOKS IN ONE! 60 FULLY ILLUSTRATED CHAPTERS
Covering 1—Modern Machine Shop Practice. 2—Blue Print Reading and How to Draw. 3—Calculations & Mathematics for Machinists. 4—Shop Physics. 5—How to Use the Slide Rule.

$4 Get this information for yourself. Mail coupon today. No obligation unless satisfied. COMPLETE • PAY ONLY $1 A MO.

AUDEL, PUBLISHERS; 49 W. 23rd ST., NEW YORK
Mail AUDELS MACHINISTS & TOOLMAKERS HANDY BOOK. Price $4 on 7 Days Free Trial. If O. K. I will remit $1 in 7 days and $1 monthly until $4 is paid. Otherwise I will return it.

Name_____
Address_____
Occupation_____
Reference_____
A.M.M.

GOOD USED MACHINERY

AIR COMPRESSORS

136', 8"x8" **Chicago Pneumatic Tool Co.**, type N8B.
136', 8"x8" **Ingersoll Rand**, type ERI.
550', **National** 3-cylinder vertical
620', 14"x8¾"x10" **Sullivan**, class WJ3, angle compound
706', 17"x9¾"x12" **Sullivan**, class WJ3 angle compound
868', 17"x10"x12" **Chicago Pneumatic Tool Co.**, type OCB
1400', 20"x12"x14" **Sullivan, class WJB**

BULL DOZERS

Nos. 5, 6 and 29 **Williams & White**

BROACHES

No. 1 **LaPointe**, screw type
No. 2 **Standard** screw type broaching press
No. 3 **LaPointe of Hudson**, screw type
No. 3 **J. N. LaPointe** double screw type
No. 3 **American** high speed, rack type

DRILLS, UPRIGHT, GANG AND HEAVY DUTY

20" **Excelsior** plain hand feed
20" **Silver** plain hand feed
20" **W. F. & J. Barnes** plain hand feed
21" **Superior** plain hand or back geared power feed, tapping attachment
21" **Cincinnati** plain hand feed
21" **Cincinnati** sliding head
21" **Cincinnati** direct geared mfg.
22" **Aurora** sliding head
22" **Barnes**, sliding head, hand feed
22½" **W. F. & J. Barnes** stationary head, back gears, power feed
22½" **Mechanics** plain hand feed
24" **Cincinnati Bickford** sliding head, back geared power feed
24" **Cincinnati Drill Co.**, sliding head, power feed
25" **W. F. & J. Barnes** stationary head, back gears, power feed
25" **Superior** sliding head, back geared, power feed
26" **W. F. & J. Barnes** sliding head, back geared, power feed
26" **Bickford**, sliding head, back geared, p wer feed
26" **Hoefer** sliding head, back gears, power feed tapping attachment
28" **Aurora**, sliding head, back gears, power feed
22½" **W. F. & John Barns**, 4 spdl. h dy.
24" **Barnes Drill Co.**, hy. dy. **camel back**

DRILLS, MISCELLANEOUS

Nos. 15½, 15½F and 16 Foote Burt for Multiple heads
Garvin, Nos. 0 and 008, double end drilling and centering
Natco one and two-way lead screw tappers
Baker hydraulic, double end drill.
5 spindle **Detroit** automatic with fixtures
3 way **Foote Burt** for multiple heads
Avey motor driven unit heads, No. 2, ⅝" capacity
No. 3 **Milholland** two way drills, motor drive
4"x12" & 4"x72" **Sundstrand** double end drilling and centering
1" **Cleveland**, Model J, double end drilling, threading, pointing or turning
Type 8H **Natco** hyd. horizontal multiple
Barnes heavy duty vertical hydraulic for boring & drilling

FURNACES

No. 420 **Standard Fuel Engineering Co.**
No. 0 **Stewart** crucible
21"x32"x21" **Surface Combustion Co.** heat treating
45"x46"x45" heating for forge work
No. 515 **Standard Fuel Engineering Co.** pot type
No. 1D **American** rotary carburizing

GEAR CUTTERS

No. 18H **Gould & Eberhardt** universal gear hobber
8"x10" No. 1 **Lees Bradner** production hobber
14"x8" No. 5A **Lees Bradner** universal hobbers
26"x8" No. 3 **Brown & Sharpe** auto spur.
36"x6" **Gould & Eberhardt** spur gear cutter
48"x10" No. 4 **Brown & Sharpe** automatic spur
15" **Gleason** bevel gear quencher
Gleason circular finishing cutters, without blades
National Tool Co. (Cleveland) Model B gear and gear shaper cutter checking machine
Lipe gear tooth chamfering machine, double spindle
No. 3 **Barber Colman** gear hobber
18" **Gleason** bevel gear generator

ROLLS

No. 1A **Ajax** taper forging, motor drive.
54" **McKay** 19 roll sheet leveler
Bay City bending rolls, 4"x3/16"

SHEARS

⅝"x6" No. 54 **Hendley & Whittemore**, punch, shear, and rod cutter with angle shear attachment
No. 1 **Long & Allstatter** alligator
Lewis alligator, 10" blade
Newbold guillotine, 2" capacity
No. O-15 **Stanley Uni-shear**
36"x18 ga. Toledo No. 418 B.
No. 1 B **Campbell Nibbler**, 3/16"x24"
18" **Pels** all steel beam shear
10 KVA **"DYER"** Topeka 220 v. new

WELDERS

12 KVA **American Electric Fusion**, type BW 16.
17 KVA **Thomson Gibb**, 440 V., spot
20 KVA **Agnew**, type 10D, 440 V., spot
20 KVA **Taylor**, 440 V., spot, 14" reach
20 KW **Taylor Moesta**, 440 V., portable gun type spot
20 KW **National**, spot, 28" reach, 220 Volt
23 KVA **Winfield**, 440 V., spot
25 KW **Winfield**, spot, 220 V.
25 KW **Winfield**, 220 V., butt
30 KVA **Thomson**, 220 V. butt
35 KW **Federal**, type 60, 440 V., automatic upset butt
65 KW **Federal**, type 10A, 440 V., butt
150 KVA **American Electric Fusion**, type HJ 10, 440 volt, air operated multiple welder
150 KVA **Swift** flash butt welder, 440 Volt
375 KVA **Fisher "Autocraft"** press type.

MISCELLANEOUS

6A **Potter & Johnston** automatics
4'x¼" **Cincinnati** press brake
36" **Niles** car wheel vertical borer
22", 24" & 28" **Steinle** turret lathes
5" **Barrett** horizontal mill
4" **Beeman & Smith** double end boring mill
36" **Morton** draw cut shaper
12" **Dill** slotter.
3" No. 6 **Langelier** swager
Excello 9 spindle borer.
Blakeslee and Conveyor spray type degreasers
AC die casting machine
No. 61AA **Bodine** screw & nut driver
Norton type 15 lapper

Mail us your list of surplus machinery and let's "Keep 'em Flying"

MILES MACHINERY CO. - - - Saginaw, Mich.

HIGH GRADE MACHINE TOOLS

LATHES

14" x 6' Hendey Engine Lathe, Q.C. Cone Drive.
17" x 8' Sidney H.D. Lathe, Q.C. 3SCD, D.B.G.
18" x 8' LeBlond Lathe, 3 S.C.D. D.B.G. Q.C.
21" x 10' LeBlond H.D. 3 S.C.D. B.B.G. Q.C.
20" x 8' American Lathe, 3 S.C.D. D.B.G. Q.C.
14" x 6' Lodge & Shipley Lathe, 3 S.C.D. D.B.G. Q.C.
20" x 8' LeBlond H.D. Lathe, 3 S.C.D. D.B.G. Q.C.
42" x 16' Niles Lathe, Standard Change, Cone Drive.
28" x 50" x 16' Rahn Larmon Slid. Bed Gap Lathe, Q.C.

GRINDERS

#60 Heald Internal, Belt Drive.
12" Pratt & Whitney Surface Belt Drive.
#14—20" Besley Disc Grinder, Belt Drive.
12" x 72" Cincinnati Universal, Belt Drive.
#41 Oliver Drill Grinder, M.D.

GEAR CUTTERS

#3—26" B & S Automatic Gear Cutter.
#1 Adams Gear Hobber, Belt Drive.

BORING MILLS

36" Bullard Vertical, Two Heads, M.D.

BOLT & PIPE THREADERS

4" Williams Pipe Machine.
2" Landis Pipe Machine.
2" Landis Dble. Spindle Bolt Threader.
⅛" Acme Bolt Cutter Class A.
1" Acme Bolt Cutter Class A.

RADIAL & UPRIGHT DRILLS

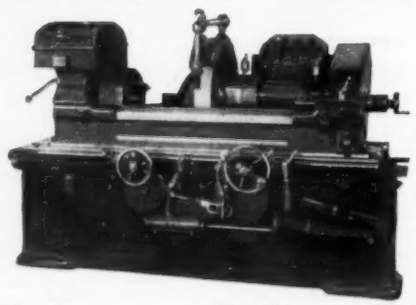
24" and 26" Barnes Upright Drills.
2' & 4' Fosdick Plain Radial Drills, S.P.D.
6' Niles Universal Radial Drill, S.P.D.

SHAPERS & PLANERS

24" Stockbridge Crank Shaper.
24" Queen City Crank Shaper.
48" x 48" x 20' Niles Planer.
24" x 24" x 6' Cincinnati, Planer.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

HILL-CLARKE MOTOR DRIVEN GRINDERS



SIZES

10 x 36	14 x 36	14 x 96
10 x 50	14 x 50	16 x 50
10 x 72	14 x 72	16 x 72

HILL-CLARKE MACHINERY CO.
651 WASHINGTON BLVD. CHICAGO

TURRET LATHE

Steinle 24" Geared Head, with 22" chuck, 6¼" hole through spindle, power feed to turret, power feed to cross slide, motor drive.

ACME EQUIPMENT COMPANY
128 S. Clinton St. CHICAGO

OTT MACHINERY SPECIALS

AUTOMATICS, B. S. #00 & 1 Cut off
AUTOMATICS, Cleveland 1¼ & 2" Model B, M.D.
AUTOMATICS, #22, 23 & 24 New Britain
GRINDERS, B. & S. #16 Plain 10"x72"
GRINDERS, Landis 10x36" Hydraulic, M.D.
GRINDERS, Persons & Arter—16" Mag. Chuck.
LAPPER, Norton #15 Vertical, M.D.
MILLING MACHINE, Lees-Bradner #3 Thread
PLANERS, 44x44x18' Niles 4 heads
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo #14 & 14½ Horning, M. D.
PRESSES, Ferracute, P2, 3 & 4, Solid Back

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

MISCELLANEOUS MACHINES

#13 **NATCO** Mult. spdl. rect. hd. bored 16 spdls, with 8-1¼" spindles
#60 **NATCO** 3-way Multiple Drill
25" **Barnes** B.G. P.F. Sliding Head Drill
25" **Rockford** B.G. P.F. Sliding Head Drill
2-spdl. **Leland Gifford**, 10" overhang
4-spdl. **Henry & Wright**, 7" overhang
Rockford Sgl. End Hydraulic Boring Unit, with 3-sta., 54" dia. table
Gisholt Universal Tool Grinder

THE STRONG, CARLISLE & HAMMOND CO.
1392 West 3d St. Cleveland, Ohio
2832 E. Grand Blvd., Detroit, Mich.

DEPENDABLE MACHINERY ★★ FALK—

GRINDERS—Cylindrical

20"x120" LANDIS Self-Contained, Motor dr.
10"x48" BROWN & SHARPE, No. 14; Belt Dr.
12x36" CINCINNATI Plain, Arr. Motor Dr.

20"x120" Landis Plain Cylindrical Grinder Self Cont'd, Motor drive, Serial 8034.

DISC GRINDERS

No. 2 Norton Universal Tool & Cutter Grinder. (2 in stock.)
Gardner No. 8—40" disc, 30" Ring Wheel, B.B. Belt Dr.
Gardner No. 4—30" Disc., 16" Ring Wheel, B.B. Belt Dr.
Badger No. 2—16" Disc, Double End, Univ. Tables, Belt.
Gardner No. 1—double end Disc, 12", B.B. belt dr.
GARDNER No. 14, Ball Bearing, double opposed, 20" discs.

SHAPERS & SLOTTERS

15" HENDEY, Friction Drive (5), $450 ea.
20" CINCINNATI, Geared, Crank, complete.
24" Stockbridge, Geared, Crank, Heavy. Cone dr.
20"x20"x24" N-B-P SHAPER-PLANER, Motor Dr.
10" NEW HAVEN SLOTTER, 30" Rotary Table.
12" New Haven Slotter; 32" Rotary Table.
15" Smith & Mills, Single Geared, Crank, Cone dr.
12" Gould & Eberhard Back Geared, crank, cone dr.
7" Rhodes combination Shaper and Slotter, belt dr.

LATHES

42"x25' PUTNAM triple geared, 17'6" centers; Plain change gear, screw cutting.
36"x18' PRENTICE Lathe 9' Centers—Pl. chge. screw cutting, chuck and standard equipment.
22"x16' REED light Pattern, Pl. Change gear; 11" Centers, $750.
19x8 LEBLOND Production Turning Lathe
14"x16' MONARCH cone dr. quick change; Draw in bar & Collets, Chuck, etc.
11"x4½' DAVIS pl. change screw cutting engine lathe; complete; $225.
10"x4' LOGAN (NEW) Lathes, Ball Bearing Spindle; ½" Collet capacity; arranged for motor drive; power cross feed; $225, f.o.b. factory; priority certificate required; shipment from stock.
7"x36" PRECISION BENCH LATHES—Hardinge, Sloan & Chase and others.
8"x108" FITCHBURG LO-SWING LATHE; SPD.
18"x12' HAMILTON pl. Change, Cone dr. chuck.
11"x4' PRATT & WHITNEY TOOLMAKERS LATHE, Taper att.
16"x6' SOUTH BEND pl. Chge., Screw Cutting Engine Lathes (2).

COLD HEADERS
#22 Waterbury Farrell Cold Headers Dble stroke Solid Die also #11.

TURRET LATHE

GISHOLT 24"x6¼" Universal, Taper attach. Chuck, Tooling. Motor dr. perfect condition, immediate delivery. Rare bargain.
JONES & LAMSON 3x36 Double Spindle Very fine condition.

RADIAL DRILLS

DRESES 3' Arm, Plain Radial, Motorized; REBUILT—READY TO GO.
DRESES 4' Arm, Plain Radial, cone dr.

DIE CASTING MACHINES
3—MADISON-KIPP late model, 10"x12", 12"x14", 12"x16".

GEAR CUTTERS

No. 2 WHITON SPUR GEAR CUTTER, Auto.
36" Gould & Eberhart, "Victoria Model" perfect Cond.
48" Gould & Eberhart, Motor Driven; Complete; Perfect Cond.
No. 36B Gould & Eberhart Spur and Bevel Gear Cutter, Motor Dr.
No. 0, No. 1, No. 2, No. 3 STANDARD AUTOMATIC GEAR CUTTERS, BILTONS.

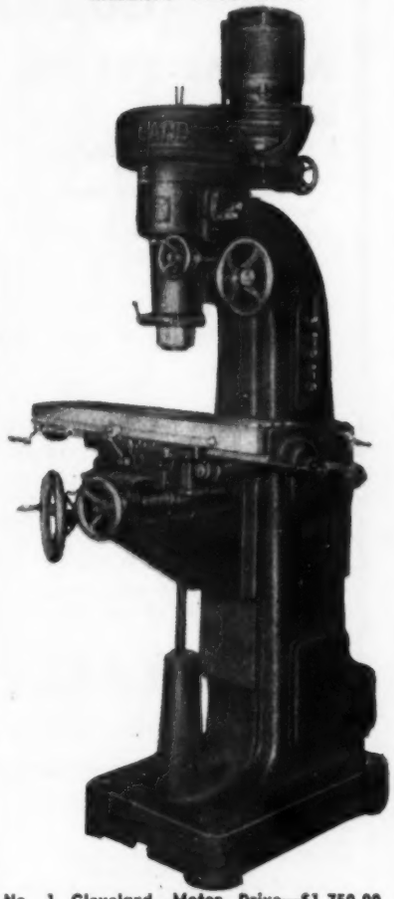
HAMMOND 10 H.P. BUFFERS—8 months old. Motors in base, 3-60-220/440.

PROFILERS

No. 2 GARVIN SINGLE SPINDLE Belt dr.

14' SOUTHWARK ⅝ Plate Capacity "Pyramid Type Bending Roll." With drop end housing. All geared drive, arranged motor drive.

SUDDEN DELIVERIES MILLING MACHINES



No. 1 Cleveland, Motor Drive—$1,750.00. Coolant Pump, Motor $95.00 Extra. cap. 18" longit. feed 16" Vertical travel 8½" cross travel table working surface 8"x32"

No. 12 Pratt & Whitney Lincoln Production Miller.
No. 2 Pratt & Whitney Lincoln Production Mill.
No. 2 Kempsmith Lincoln Production Mill.
No. 2 GARVIN DUPLEX PRODUCTION MILL.
No. 12 PRATT & WHITNEY DUPLEX PRODUCTION MILL.

PUNCH PRESSES

No. 18, 18C, 19, 19C, 20B Bliss, O.B.I.
No. 19 Truesdale OBI.
No. 4 Adriance OBI.
No. 46 MICHIGAN OBI.
No. 4 V & O—OBI.
No. 6 Waterbury Backed Geared, Open Back.
No. 73½ BLISS S.S. Plain flywheel.
No. 4 Bliss Back Flywheel Geared.
No. 2 BLISS Back Flywheel Plain, (6).
No. 1—Bliss Back Flywheel Plain.
No. 3R—Marquette Geared, Motor Dr.
No. 15N BLISS, arr. Geared, Motor dr. (2).
No. 25N BLISS Geared, Motor dr.; (3).
No. 1 BLISS S.S. Toggle Press.
No. 1½ BLISS S.S. DBLE. ACT. CAM PRESS.
No. 41 TOLEDO HORN PRESS, arr. Motor dr.
25 Ton Henry & Wright High Speed Press, dble. roll feeds.
No. 1038 BLISS GANG DIE PRESS; Roll Feed.
No. 4½ BLISS three column Forging Press with Taper Rolls.
6 Ton General Flexible Press.
12 Ton Fox Flexible Press.
400 lb. Chambersburg board Drop Hammer.
1500 lb. Chambersburg Steam Hammer, single leg.
50 lb. DuPont Blacksmith Hammer.
15 lb. Bradley upright Strap Hammer.
No. 30 BLISS ARCH PRESS, Plain.
No. 25 NIAGARA ARCH PRESS, Plain.
No. 71 Waterbury Coining Press 25 Tons.
No. 93D TOLEDO DBLE. CRANK GEARED S.S. PRESS, Welded Frame.
No. 75 Toledo Open Back Plain Flywheel Press.
No. 16 Bliss Horn Press, 3" stroke, Motor Driven.
No. 2 Niagara OBI; No. 0 V & O (3).
No. 3 American Can Co. OBI.
No. 53 Perkins Sprue Cutter.
No. 5 Middleditch Sprue Cutter.
No. 1—100 lb. Standard Automatic Drop Hammer.
No. 702—BLISS TRIMMING PRESSES (2) Flat.
No. 4 Waterbury open back, rigid bed, plain.
520 Ton Southwark Hydraulic with Laurie Pump.
SHERIDAN EMBOSSING PRESS, 24x36.
#7H Cleveland HORN PRESS back geared, 8" stroke with screw elevating cable, 42 tons.
#39B Bliss HORN PRESS
#4 Bliss, double crank GEARED PRESS, 4" stroke, bed 32x28

AUTOMATIC CHUCKING MACHINES

2—No. 24 New Britain type 5 spindle.
1—No. 23 New Britain type 5 spindle.
1—J&L HARTNESS AUTOMATIC CHUCKING LATHE; motor driven, 6"x12".

BROACHING MACHINE

Cincinnati SURFACE BROACHING MACHINE, model #5-54 duplex. New in 1937.

PUNCH & SHEARS

WICKES COMBINATION PUNCH AND SHEAR; MOTOR DRIVEN; 1¼" thru 1" Plate; Punching end 48" throat; Shearing end 36" throat; Continuous 6"x1" Plate.
LONG & ALLSTATER No. 2—24" Throat, arr. motor dr. Capacity 1" thru 1".
Niagara 36" foot Shear, 16 ga.
Kutscheid all steel 36"x16 ga. Foot Shear.
Pexto 48"x16 gt. Foot Shear.
Pittsburgh 36"x¾" Plate Shear, no holddown.
UNITED ENGINEERING Plate Shear 42"x3/16 no holddown.
No. 216D NIAGARA RING AND CIRCLE SHEAR, Motor Dr.
No. 236 PEXTO CIRCLE SHEAR, SPD; 16 ga.
No. 132 BLISS 14 ga., 12" throat, Slitter.
No. 232 Bliss 12 ga., 18" throat, Slitter.
12"x¾" and 6"x¾" STAMCO MILL PACK SHEAR.
BLISS 24"x16 ga. POWER SHEAR—Perfect for Tin Plate.

COILING MACHINES

No. 1 and No. 2 SLEEPER & HARTLEY BX CABLE COILING MACHINES ⅜ and ½" cap. Last used for Speedometer cable. Complete.

KEY SEATER

No. 3¼ BAKER 72"x3" Cap. immediate delivery.

HAND SCREW MACHINE

#2 BARDONS & OLIVER, Geared Friction Head, Power feed to Turret, 1" Cap. fitted with complete automatic chuck and air cylinder.

INTERNAL GRINDER

GREENFIELD No. 12, HYDRAULIC FEED, Motor Drive; Cap. swings 15" Grinds automatically ¾" to 5" dia.; 4" Deep; **New in 1928.**

5" Bar BETTS Knee Type Horizontal Boring Mill, M.D.

DRILL PRESSES—HIGH SPEED, BALL BEARING; SLIDING HEAD; SCREW EL. TABLES

4-Spindle Foot-Burt High Speed Ball Bearing with power feed to each spindle; automatic quick return, tight and loose pulley drive; 8" overhand No. 2 Morse Taper; table working surf. 14"x48".
1-Spindle Avey No. 3, 12" Overhang, No. 3 M.T. with Power feed; Ball Bearing.
1-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. with Power Feed; Ball Bearing.
2-Spindle Avey No. 2, 8" overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
3-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
2-Spindle Leland Gifford No. 2 M.T. 10" Overhang, Power feed to one Spindle.
2-Spindle KERN No. 2 M.T. 8" Overhang.
2-Sp. Henry & Wright, 8" Overhang, No. 2 M.T.
1-Sp. EDLUND No. 2B, 8" Overhang, No. 2 M.T.
1-SPINDLE ALLEN No. 2 M.T. 8" Overhang.
1-Spindle FOSDICK with TAPPING MECHANISM On SPINDLE No. 2 M.T. 8" Overhang.

NEW LINES—WE SELL DREIS & KRUMP "CHICAGO" PRESS BRAKES AND BENDING BRAKES; STREINE POWER SQUARING SHEARS; BUFFALO DRILLS AND IRON WORKERS; CLEVELAND MILLING MACHINES; INDEX UNIVERSAL VERTICAL MILLERS; TROYKE ROTARY TABLES; L-W LATHE CHUCKS; INDEX HEADS; MAGNETIC CHUCKS AND HACK SAWS; VISES; OSWEGO MACHINISTS BENCH VISES; B-LINE MOTORS; VALLEY ELECTRIC GRINDERS; INQUIRIES INVITED.

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

...IN STOCK

AUTOMATICS
No. 515 National Acme, four spindle
No. 52 National Acme, four spindle
No. 54 National Acme, four spindle
1—¾" Gridley, four spindle

BROACHES
No. XA4 Oilgear Hydraulic
No. XB10 Oilgear Hydraulic Twin Spindle
15 Ton Hercules Vertical

DRILLS
4' Prentice Radial
No. 17 Foote Burt, 2 spindle
No. 1 Bausch, 8 spindle
Pratt & Whitney Gim Barrel, 2 spindle, m.d.

GEAR CUTTERS
No. 6 Fellows Gear Shaper
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester
No. 5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder

GRINDERS
12"x42" Landis Cylindrical
14"x72" Norton Cylindrical
16"x50" Norton Crankshaft
No. 55 Heald Cylinder
No. 60 Heald Cylinder
No. 2 Diamond Surface
No. 24 53' Gardner Disc

LATHES
17"x8' Sidney, c.d.
18"x6' Sidney, c.d.
18"x8' Chard, c.d.
20"x8' Wickes Production, c.d.
3½"x60" Fitchburg Lo-Swing, q.h.

TURRET LATHES
No. 6A Potter & Johnston, q.h.
No. 2A Warner & Swasey, q.h.
3x36 Jones & Lamson, q.h.

MILLS, BORING
2½" Cleveland Horizontal, s.p.d.

MILLS, PLAIN
No. 3 Cincinnati, c.d.
No. 2 Kent Owens, m.d.
No. 2 Kent Owens, p.f.
No. 8 S Becker Duplex, c.d.
No. 4 Hendey Lincoln Type, c.d.

MISCELLANEOUS
No. 227 Dreis & Krump Leaf Brake (12"x3/16") m.d.
5/8"x18' Nilson Wire Straightener
Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill

PLANERS
22"x22"x6' Gray
26"x26"x8' Gray
30"x30"x8' Ohio

TAPPERS
No. 14V Rickert Shafer
½" Rickert Shafer Radial

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

1959-69 South Meridian Street
INDIANAPOLIS, INDIANA

Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

USED MACHINE TOOLS
GUARANTEED BY
A TIME TESTED, RELIABLE COMPANY

DRILLS
1 2 4 spdl. Henry & Wright
1 spdl. Leland-Gifford
2 spdl. Leland-Gifford Bench
4 spdl. Sigourney
4 spdl. Woodward & Rogers
No. 1 Baush Multiple

GEAR CUTTERS
No. 4—48" Brown & Sharpe

GRINDERS
Hill-Clarke Production Universal
12x36 12x50 12x72
(See page 298 special advertisement Hill-Clarke Cylindrical Grinders)
No. 40 Bryant Plain, Wide Wheel, Oscillating
No. 10 Lees-Bradner Spur Gear Grinder
No. 5 Springfield Planer Type Surface
1½" dia. New Yankee Drill Grinder

LATHES
No. 4 AC Leblond Auto. Duplex Crankshaft
26"x10' Bridgeford
26"x10' Walcott, Q. C. G.
30"x12' Whitcomb-Blaisdell

PLANERS
24"x24"x12' Gray
36"x36"x8' Cincinnati

MISCELLANEOUS
60" Quickwork Rotary Shear
No. 3-B J. N. Lapointe Broach
No. 4 J. N. Lapointe Broach
6" Saunders Pipe Machine
No. 12 Bignall & Keeler Pipe Machine
No. 4 Gaterman Tapper

HILL-CLARKE MACHINERY CO.
651 W. WASHINGTON BLVD. CHICAGO

LATHES
9"x18" Porter Cable Lathes (2)
No. 324 Adriance Spinning
26"x10' LeBlond, Universal Crankshaft
MILLING MACHINES
2" Pratt & Whitney spline (duplex) (Double)
2K Kearney & Trecker Vertical
4B Heavy Brown & Sharpe Plain
New No. 3 Wigglesworth
TURRET LATHES
4D Potter & Johnstons (2)
2¼" & 24" Jones & Lamson steel HD. M.D.
3'x36 Jones & Lamson steel Hd. M.D.
2 spindle Jones Lamson steel Hd., M.D.
Goss & De Leeuw Chucking, 6"x6½"
RADIAL DRILLS
3' Carleton 3½ American Triple Purpose
3' Morris No. B-16 Natco Multiple Spindle
GEAR MACHINERY
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
MISCELLANEOUS
No. 2 & 6" Campbell Nibblers
15 KVA, Taylor Spot Welders
No. 1 Foote-Burt Duplex Surface Broach
8" Welland Standard Pipe Machine
No. 4 Hilles & Jones Double End Punch and Shear
No. 303 Bliss St. Side Gd. M.D.
No. 3 Adriance Inc. Press
No. 23 Stoel Horning Press
No. 4 Chas. Loeffler Inc. Press
2" Acme Bolt Threader
No. 1 Baker Keyseater
No. 4 Garvin Profiler

WIGGLESWORTH MACHINERY CO.
203 Bent St., Cambridge, Mass.

UNUSUAL VALUES

Shapers: 24" G&E.
28"x20'6" Rahn-Carpenter Lathe 14' between centers
12"x6' Seneca Falls lathe, loose change gear.
15"x6' South Bend, loose change
16"x8' South Bend, loose change
18"x8' Champion, quick change
Broaching Machines, LaPointe, #1, #3
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement
Ceiling Suspended Drill Unlimited drilling area
2 50# Bradley upright hammers, m.d. like new
Radial Drills: 5" Bausch
Miller: 20"x24"x18" Ingersoll
Grinders: #20 Bryant Internal
300 other machinery items
Rock River ⅞" capacity punch and shear
MOTORS—new 5 H.P. for 3-phase, ball brg.

Also rebuilt motors.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

POWER PRESSES
BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED
JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

AUTOMATIC SCREW MACHINES

1—1¼" CLEVELAND — 1 Spindle Model A.
1—½" CLEVELAND — 5 Spindle Model M.
5—No. 515 & 52 NATL. ACME—4 Spindle—⅝" & ¾" Cap.
1—12" x 36" MODERN Plain Cyl. Grinder.

INLAND MACHINERY CO.
48 S. CLINTON ST. CHICAGO

4A Brown & Sharpe Univ. Miller
4 AC LeBlond Crankshaft Lathe
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No. 3 Baush Multiple 16x30" head
No. 7D Moline 2 spindle Cylinder Borer
D11 Fox, 20x14" head
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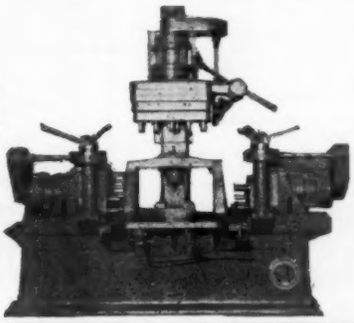
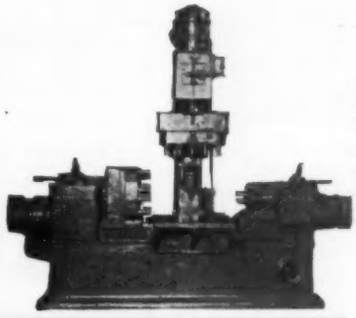
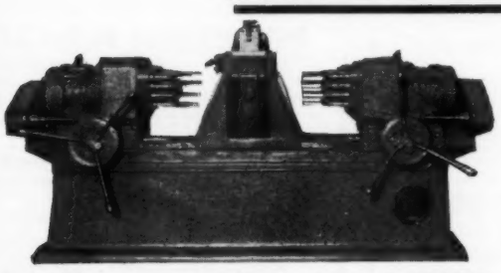
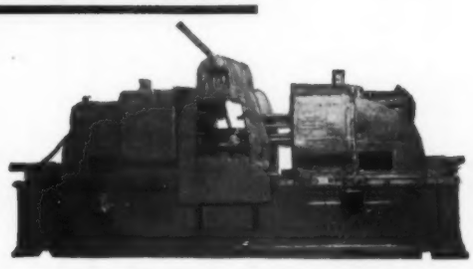




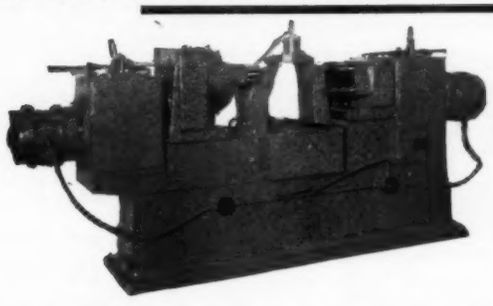
1—3 Way Leland-Gifford Multiple Drill & Tapper, 2 horizontal heads, 1 vertical head; all power feeds; all heads individual M.D.



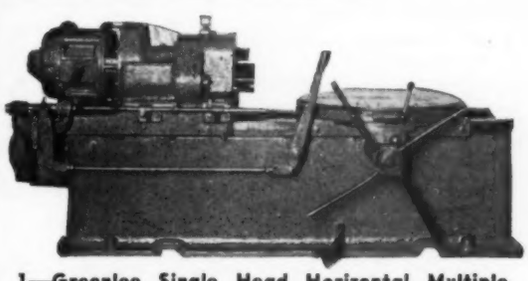
1—2 Way Leland-Gifford Opposed Multiple Drill, power feeds, both heads individual M.D.



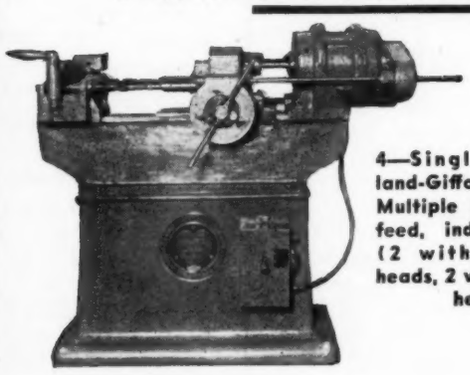
1—Greenlee Opposed Head Multiple Spindle Drill, all power feeds, both heads individual M.D.



1—Leland-Gifford Opposed Head Multiple Drill & Tapper; all power feed; individual heads M.D.



1—Greenlee Single Head Horizontal Multiple Drill, with 30" diameter indexing table, individual M.D.



4—Single Head Leland-Gifford Horizontal Multiple Drills, power feed, individual M.D. (2 with 6 Spindle heads, 2 with 4 Spindle heads.)

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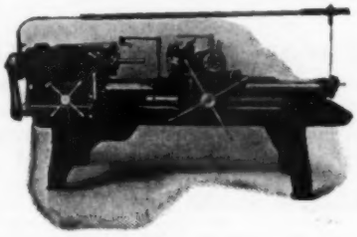

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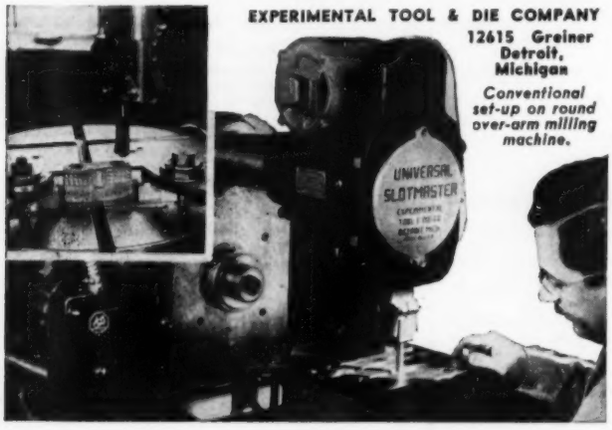

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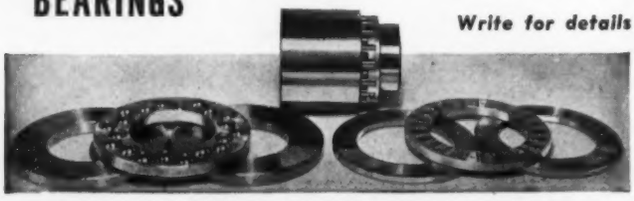

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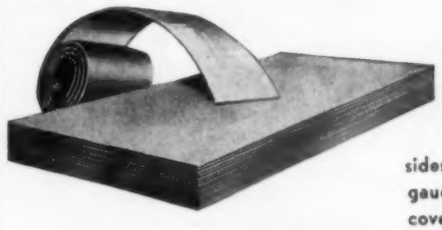

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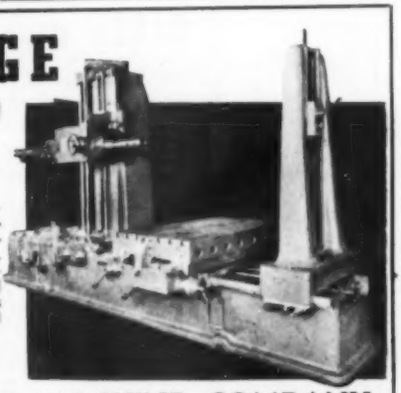

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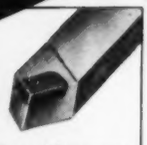

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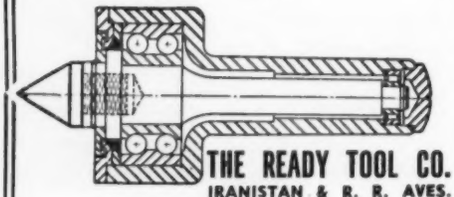

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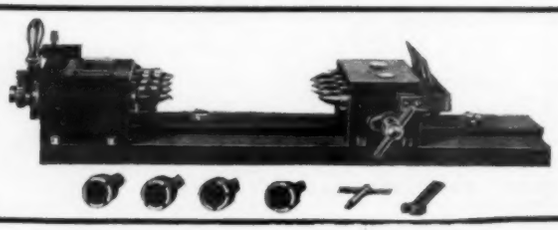

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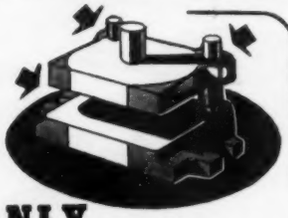

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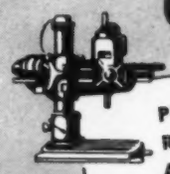

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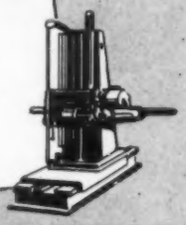

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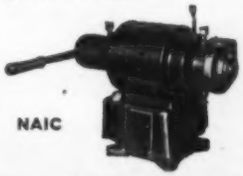

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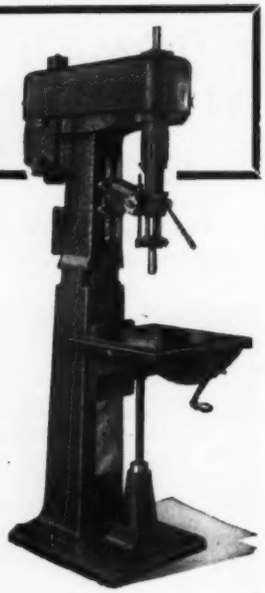

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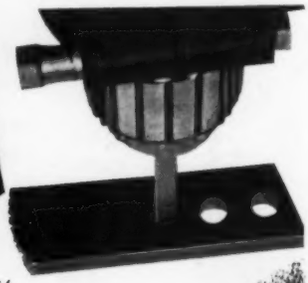

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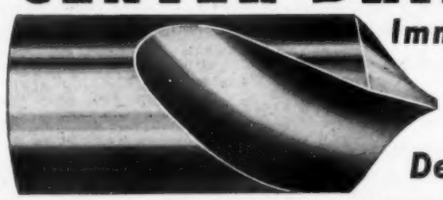

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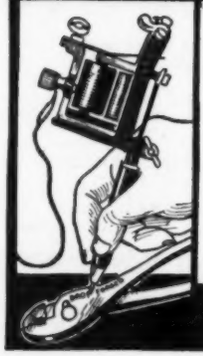

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11/32	12	9	3.75
23/64	12	9	3.75
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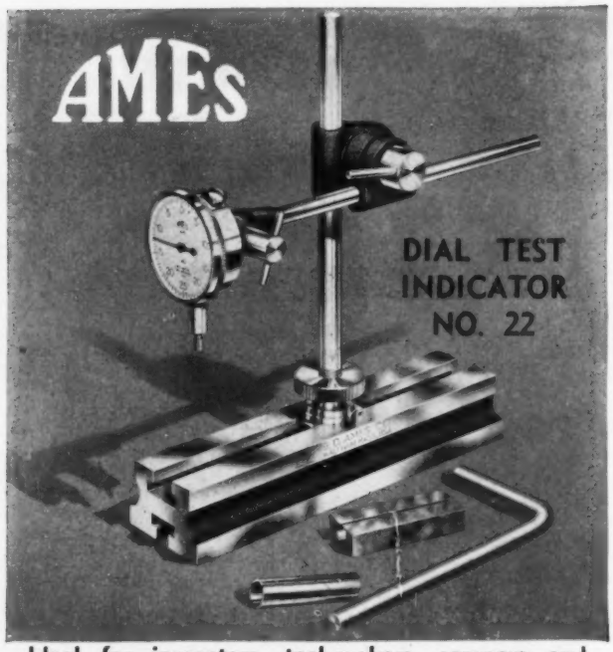

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Length over all	3 1/4"
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Back held in position by	4 large screws
Center of spindle to center of hole in lug	15/16"
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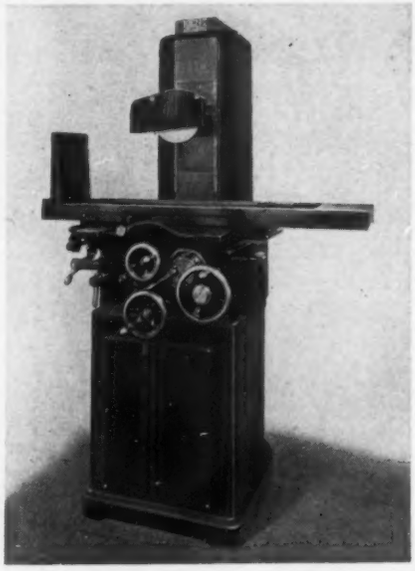

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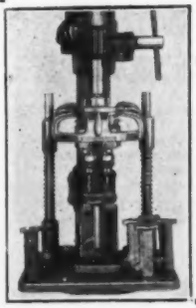

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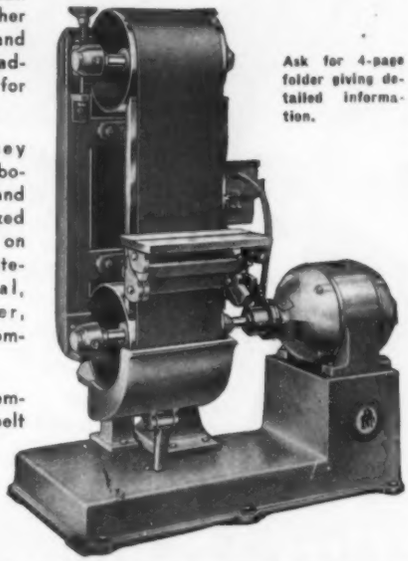

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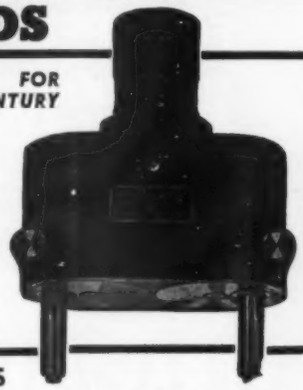

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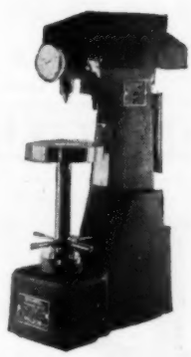

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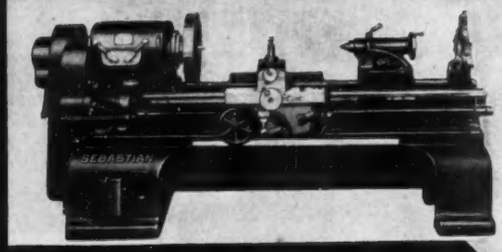

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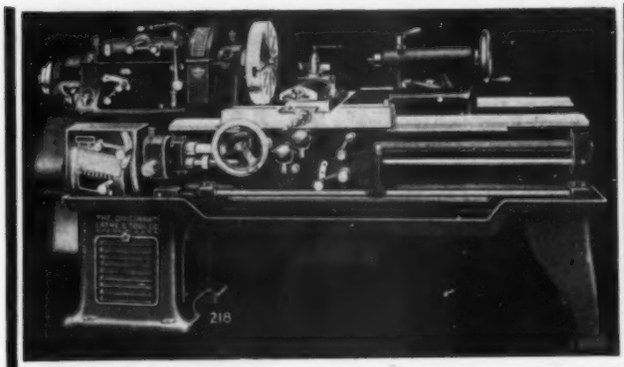

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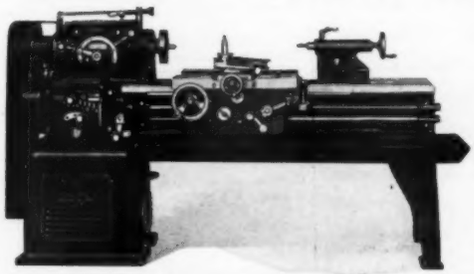

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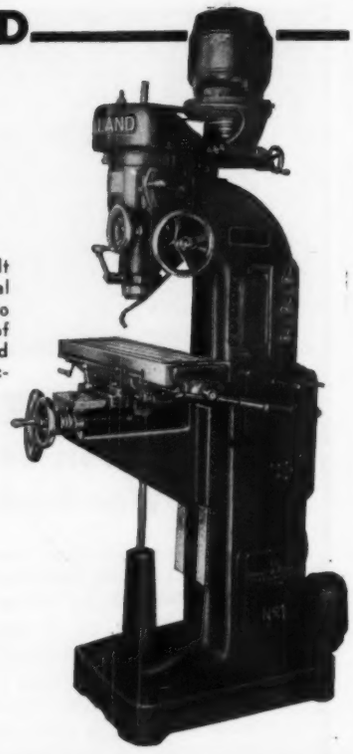
NEW
Vertical Milling Machine

Here's a new . . . rigidly built . . . high speed . . . vertical milling Machine designed to meet the growing demands of the modern Tool Room, Die and Mold Shop and many Production Plants.



Features:

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Table has 12 automatic longitudinal feeds ranging from 6" to 12½" per minute.
Capacity—Longitudinal Feed 18", Cross Travel 8½" Vertical Travel 16".
Table—Working Surface 8" x 32" with Three—1/32" T-slots 1⅞" center to center.
Power — 1½ H.P. motor, flange mounted with adjustable hand wheel for quick change of spindle speeds.
Cutter Capacity—1/16" to 2½" Mills
Floor Space—38" wide x 42" deep x 87" high.

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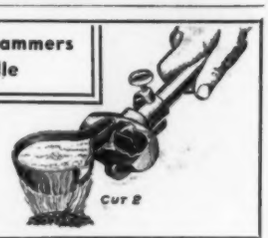

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Nicholson & Co., W. H., Wilkes-Barre, Pa.

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Mathews & Co., James E., Pittsburgh

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Sundstrand Machine Tool Co., Rockford, Ill.

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Machinery Manufacturing Co., Los Angeles, Calif.

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Cincinnati Milling Mach. Co., Cincinnati, Ohio
Douglas Machy. Co., Inc., N. Y. C.
Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee
Kempsmith Mfg. Co., Milwaukee
Knight Machinery Co., W. B., St. Louis, Mo.
Nichols & Sons, W. H., Waltham, Mass.
Ohio Machine Tool Co., Kenton, Ohio
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Consolidated Mach. Tool Corp., Rochester, N. Y.
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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Coulter Machine Co., James, Bridgeport, Conn.
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Waltham Machine Works, Waltham, Mass.

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Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
Knight Machinery Co., W. B., St. Louis, Mo.

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Gorton Machine Co., Geo., Racine, Wisc.
Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee
Kempsmith Mfg. Co., Milwaukee
Knight Machinery Co., W. B., St. Louis, Mo.
Linley Brothers Co., Bridgeport, Conn.
Machinery Manufacturing Co., Los Angeles, Calif.
Sidney Machine Tool Co., Sidney, Ohio
Sommer & Adams Co., Cleveland
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

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Cleveland Automatic Machine Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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General Electric Co., Schenectady, N. Y.

MOTORS, Integral HP
General Electric Co., Schenectady, N. Y.

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Johnson Tool Co., East Providence, R. I.

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Littell Machine Co., F. J., Chicago

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Black & Decker Mfg. Co., Towson, Md.

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Elastic Stop Nut Corp., Union, N. J.

NUTS, Self Locking
Elastic Stop Nut Corp., Union, N. J.

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Consolidated Mach. Tool Corp., Rochester, N. Y.
Liberty Planers, Inc., Hamilton, Ohio
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Rockford Machine Tool Co., Rockford, Ill.
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Lombard Governor Corp., Ashland, Mass.

PLATES, Bench
Lombard Governor Corp., Ashland, Mass.

PLATES, Steel
Jones & Laughlin Steel Corp., Pittsburgh
U. S. Steel Corp., Pittsburgh

PLATES, Surface
Lombard Governor Corp., Ashland, Mass.

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Chromium Corp. of America, N. Y. C.

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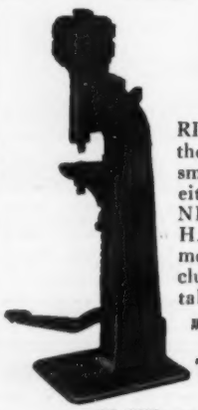

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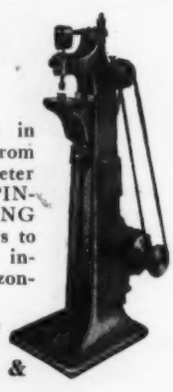

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Ruthman Mach. Co., Cincinnati, Ohio
Tomkins Johnson Co., Jackson, Mich.
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Cleveland Punch & Shear Works, Cleveland
Federal Press Co., Elkhart, Ind.
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Consolidated Mach. Tool Corp., Rochester, N. Y.

REAMERS
National Tool Co., Cleveland

REAMERS, Adjustable
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Gisholt Machine Co., Madison, Wis.
Holman Reamer Co., Manchester, Conn.
National Twist Drill & Tool Co., Detroit
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Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

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Van Norman Machine Tool Co., Springfield, Mass.

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REDUCERS, Speed
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Racine Tool & Machine Co., Racine, Wis.

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Walker Turner Co., Inc., Plainfield, N. J.

SAWS, Circular, Metal Cutting
Avey Drilling Machine Co., Cincinnati, Ohio
Disston & Sons Inc., Henry, Philadelphia

SAWS, Band, Wood Cutting
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Kalamazoo Tank & Silo Co. Machine Tool Div., Kalamazoo, Mich.

SAWS, Hack
Capewell Mfg. Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.

SAWS, Hack Frames & Blades
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Starrett Co., L. S., Athol, Mass.
Thompson & Son Co., Henry G., New Haven, Conn.

SAWS, Hole
Black & Decker Mfg. Co., Towson, Md.

SAWS, Metal
Racine Tool & Machine Co., Racine, Wis.

SAWS, Metal Cutting, Band (Machine)
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Motch & Merryweather Co., Cleveland
Starrett Co., L. S., Athol, Mass.

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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

SAWS, Power Hack
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Starrett Co., L. S., Athol, Mass.

SAWS, Screw Slotting
Disston & Sons Inc., Henry, Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

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SCREW DRIVERS, Plain
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SCREW DRIVERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.

SCREW DRIVERS, Ratchet
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SCREW DRIVING MACHINES
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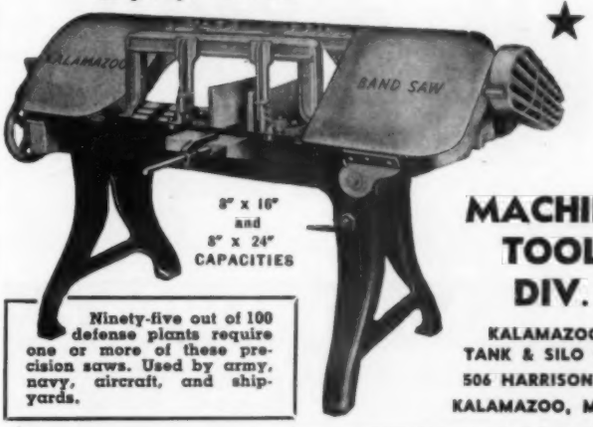

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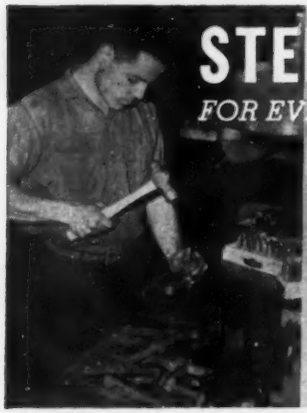

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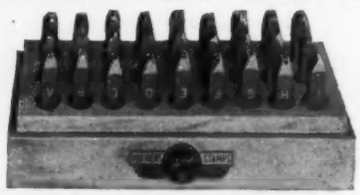

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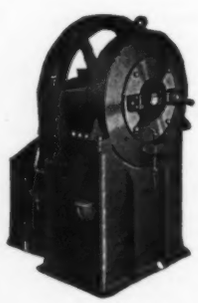

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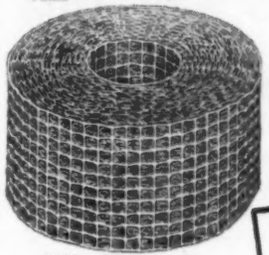

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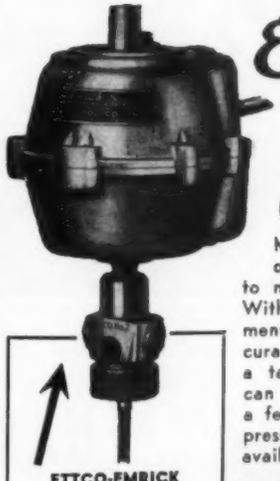

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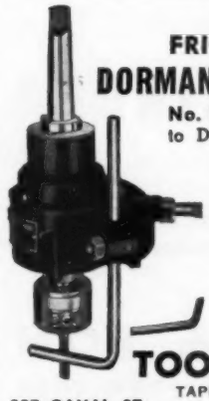

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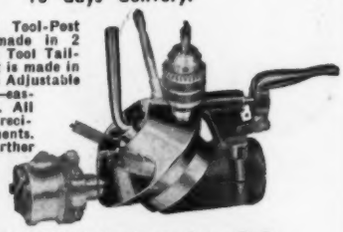

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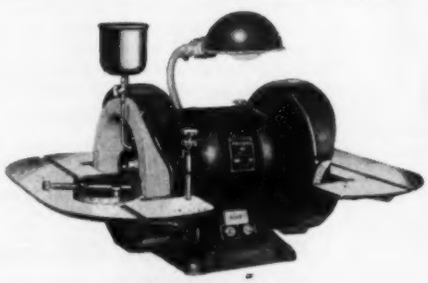

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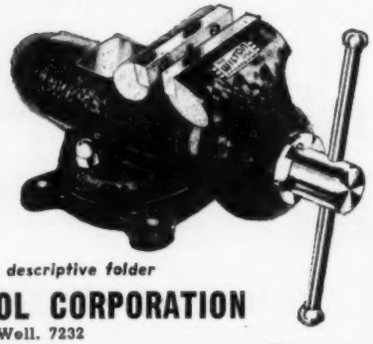

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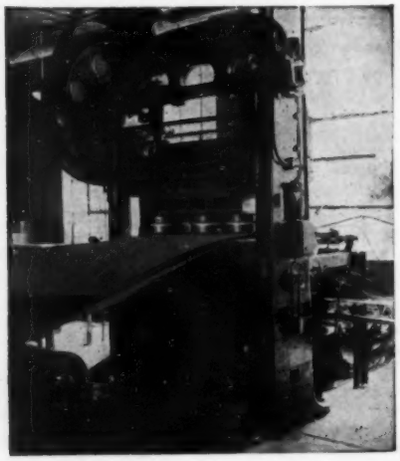

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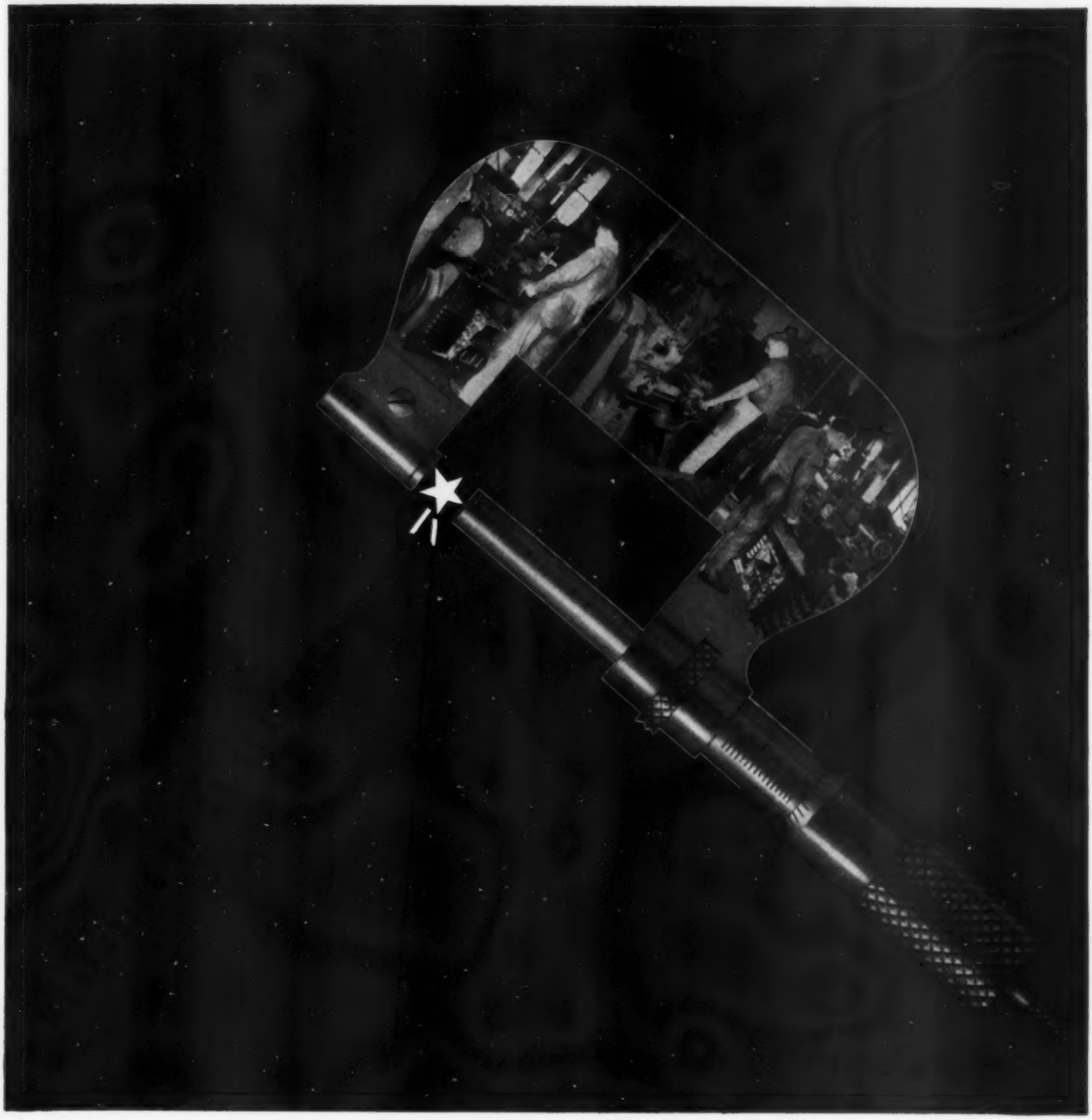

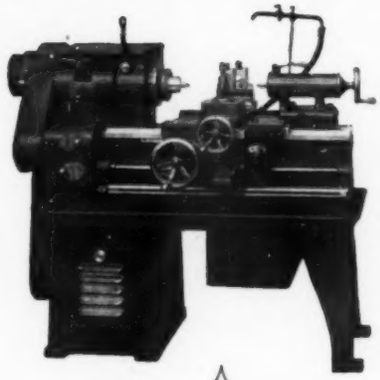

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THE R. K. LeBLOND MACHINE TOOL CO.
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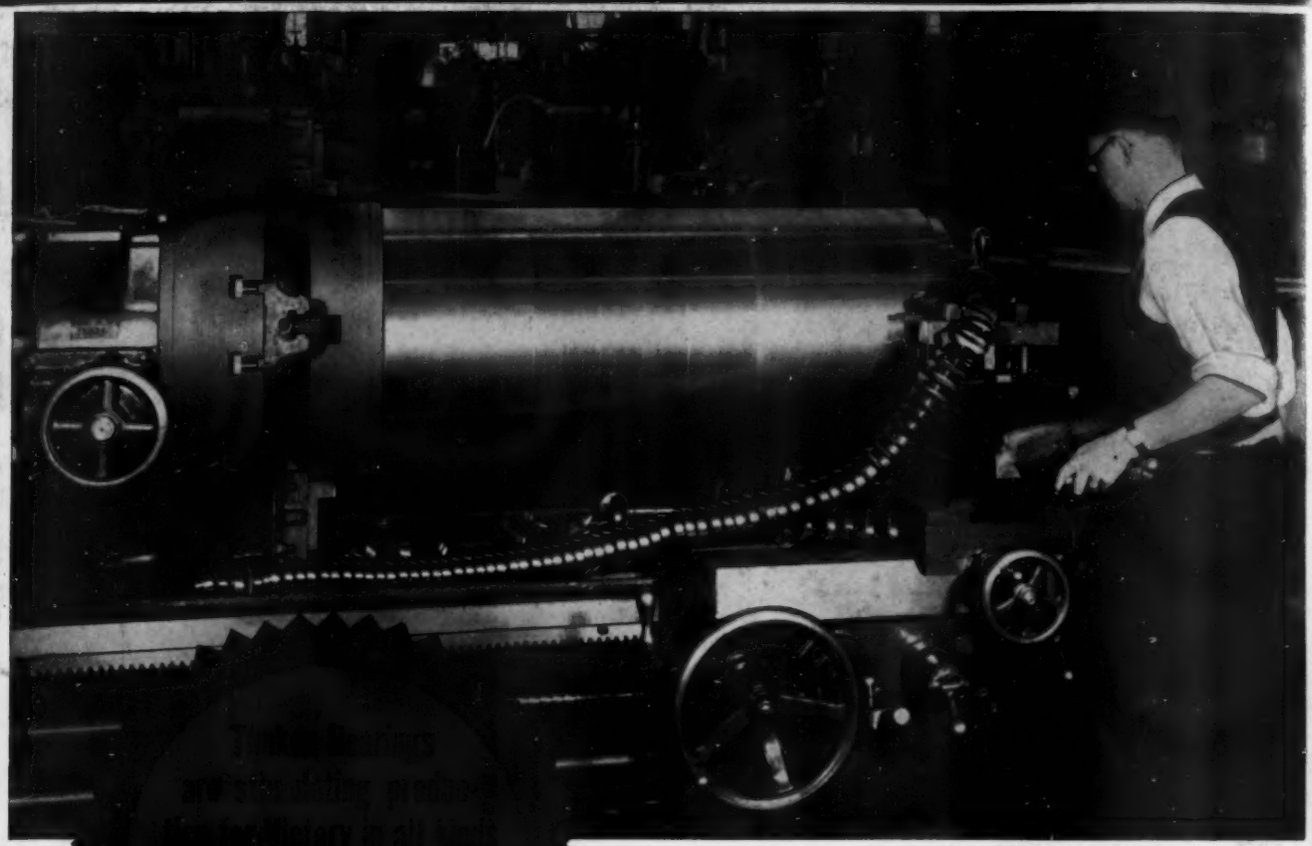
Largest Manufacturer of a Complete Line of Lathes



Lathes, milling machines, drilling machines, boring machines, gear generators, grinders, shapers, planers and specialized heavy duty machines of various kinds operate faster, have greater precision and endurance when equipped with Timken Tapered Roller Bearings—as an overwhelming majority of them are.

The photograph shows an "American" 42" Super-productive Lathe at work on one of the country's leading shipbuilding plants turning large diameter work with cemented carbide cutting tools. The spindle of this big machine is mounted on two double row Timken Bearings for maximum rigidity under all speeds, feeds and cutting loads and to promote smooth, fast operation, save power, increase endurance.

Note the length of the chip being turned off; that's definite proof of the steadiness of the spindle.

Machine tools that have seen many years of service and which originally were equipped with plain spindle bearings are satisfactorily meeting the severe demands of victory production after having the spindles mounted on Timken Bearings.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

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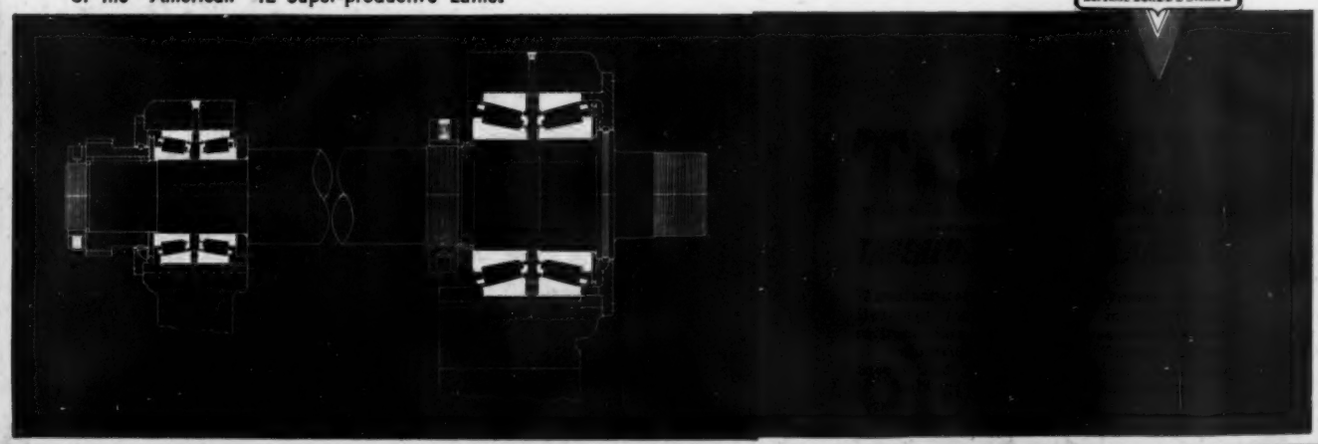
Application of Timken Bearings to the spindle of the "American" 4L Super-productive Lathe.